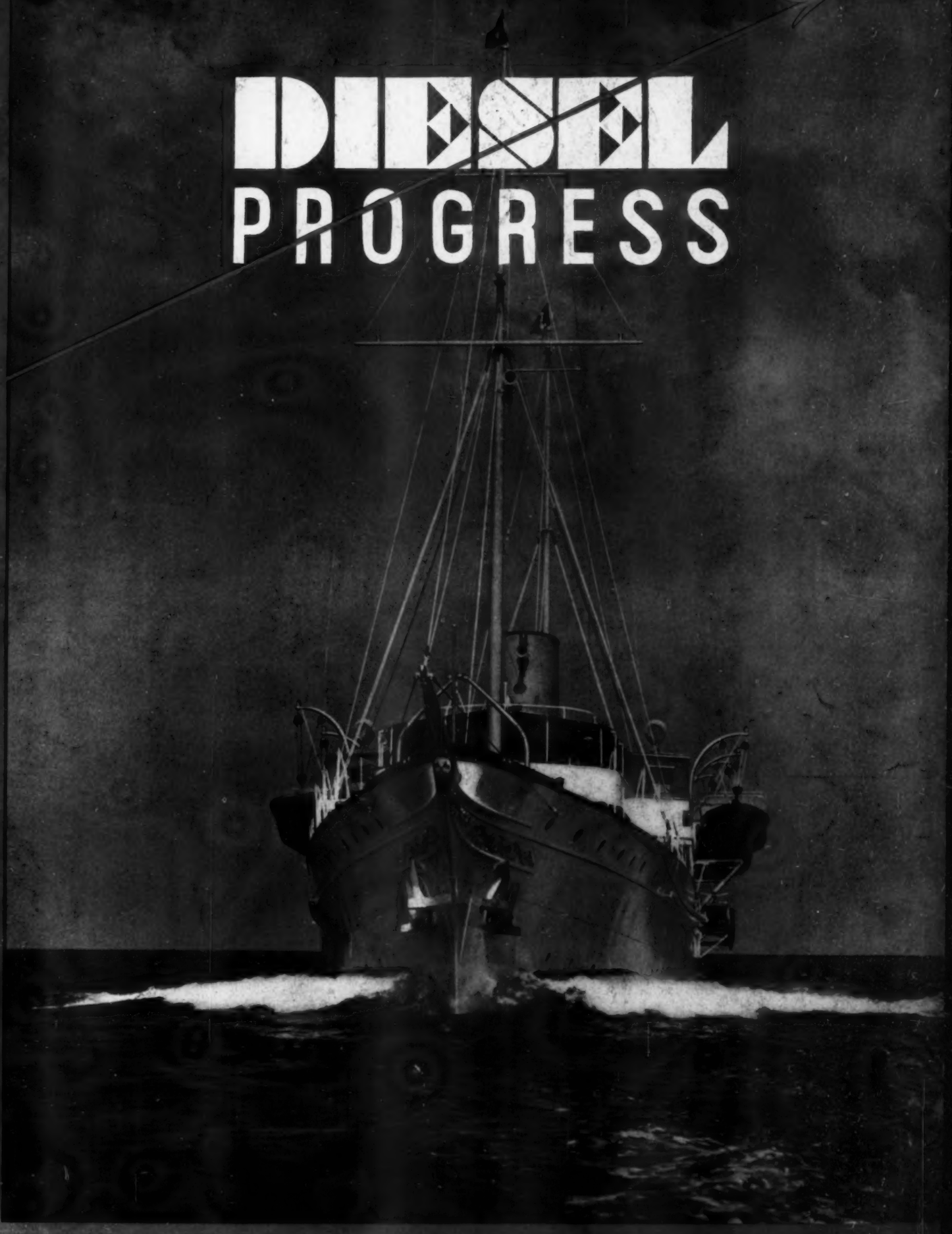
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



JANUARY, 1937 CIRCULATION OF THIS ISSUE—IN EXCESS OF 15,000 COPIES 25c

"In perfect condition after 5 years with Gulf Diesel Lubricants in service"...

SAYS INSURANCE COMPANY REPRESENTATIVE

5 Reasons

Why Gulf PARVIS OILS Reduce Diesel Operating Costs

1 **GULF PARVIS OILS** are especially manufactured for lubrication of Diesel engines. High temperatures, contamination with fuel and moisture and constant churning in the presence of air—all encountered in Diesel engine operation—necessitate the use of an oil especially prepared to withstand these conditions.

2 **GULF PARVIS OILS** insure minimum wear of cylinders, pistons and bearings. The tough film provided by GULF PARVIS OILS is not readily removed from the cylinder walls and pistons, insuring proper lubrication of these parts at all times.

3 **GULF PARVIS OILS** insure minimum consumption. Because they are made from specially selected crudes and manufactured by the most modern refining methods, GULF PARVIS OILS withstand the high temperatures encountered in Diesel engine operation. A minimum of make-up oil is required.

4 **GULF PARVIS OILS** reduce operating costs. Because of the stability and high lubricating quality of these oils, wear and repair expense are minimized. Lower oil consumption and lower maintenance costs reflect substantial savings in over-all operating costs.

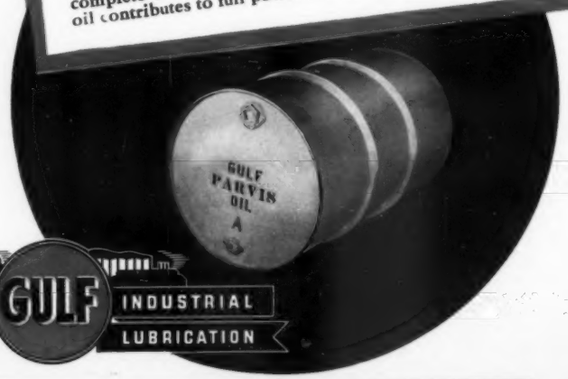
5 **GULF PARVIS OILS** are low in carbon content—a safeguard against carbon deposits resulting from the lubricating oil. With good atomization of fuel and complete combustion, rings retain their freedom. Thus, the oil contributes to full power and operating efficiency.

. . . Gulf Lubricants and Engineering Service Insure Lubricating Efficiency

"THIS engine has been kept in perfect condition with Gulf lubricants in service during the 5 years since its installation. I find only 1/1000" wear in the main bearings!" That is the statement of the insurance company representative who inspects this unit in a large plant at regular intervals.

There are three important reasons for this splendid record: First, the splendid work of the plant engineers. Second, the unparalleled quality of Gulf Diesel lubricants. Third, the cooperative service of the Gulf engineer with the men in the plant.

From Maine to Texas, Gulf lubricants and engineering service are helping Diesel operators make new records of efficiency. A Gulf engineer is always at your service.



GULF OIL CORPORATION • GULF REFINING COMPANY

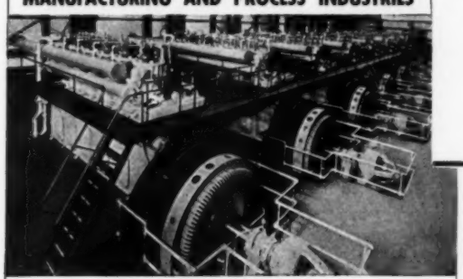
GENERAL OFFICES: GULF BUILDING, PITTSBURGH, PA.

Makers of that Good Gulf Gasoline and Gulflube Motor Oil

GULF INDUSTRIAL LUBRICATION

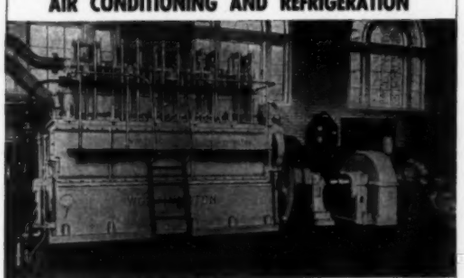
DIESEL PROGRESS for January, 1937. Volume III, No. 1. DIESEL PROGRESS published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

MANUFACTURING AND PROCESS INDUSTRIES

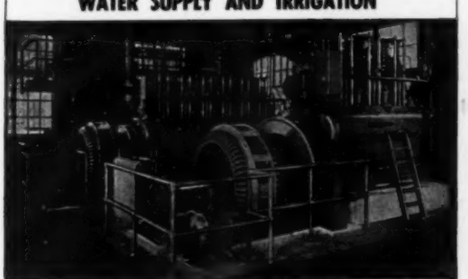


MINING

AIR CONDITIONING AND REFRIGERATION



WATER SUPPLY AND IRRIGATION



MUNICIPAL POWER AND LIGHT

In a wide range of applications...

POWER USERS ARE PROFITING by WORTHINGTON DIESEL ENGINE ECONOMY

BUILT FOR continuous heavy duty and operation at medium speeds, Worthington Engines exemplify the highest standards of modern engineering practice.

The installations here illustrated are typical of others in many fields which are building an enviable reputation for dependable economical performance.

With Worthington Air Compressors for engine starting and Worthington Centrifugal Pumps for jacket water circulating...there is added assurance of maintained trouble-free operation through the individual responsibility of one maker.

●

WORTHINGTON will be glad to submit recommendations based upon your particular power problem. A complete line backed by 35 years of successful engine building and application experience assures the proper selection for any application.

DIESEL ENGINES...25 to 1500 hp.
For any type of drive

● *Bulletins available*

WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: HARRISON, NEW JERSEY
Offices and Representatives in Principal Cities throughout the World

DE7-3

WORTHINGTON

10 TIMES MORE Diesel

Sinclair Ten-ol is a special alloyed lubricating oil developed for "Caterpillar" Diesel engines by Sinclair Refining Company. During the past several months this new Diesel lubricant has been put through exacting research laboratory and field tests.

In full power comparative laboratory tests, "Caterpillar" Diesel engines lubricated with Sinclair Ten-ol gave ten times as many service hours without shutdown as the finest straight mineral oils. In the average of all tests, consumption of Ten-ol was approximately one-half that of high grade mineral oils. In one of the tests a Diesel lubricated with Sinclair Ten-ol operated at extremely high overload with no damage to the engine and all lubricated surfaces kept in perfect condition.

Below are authentic photographs of test pistons

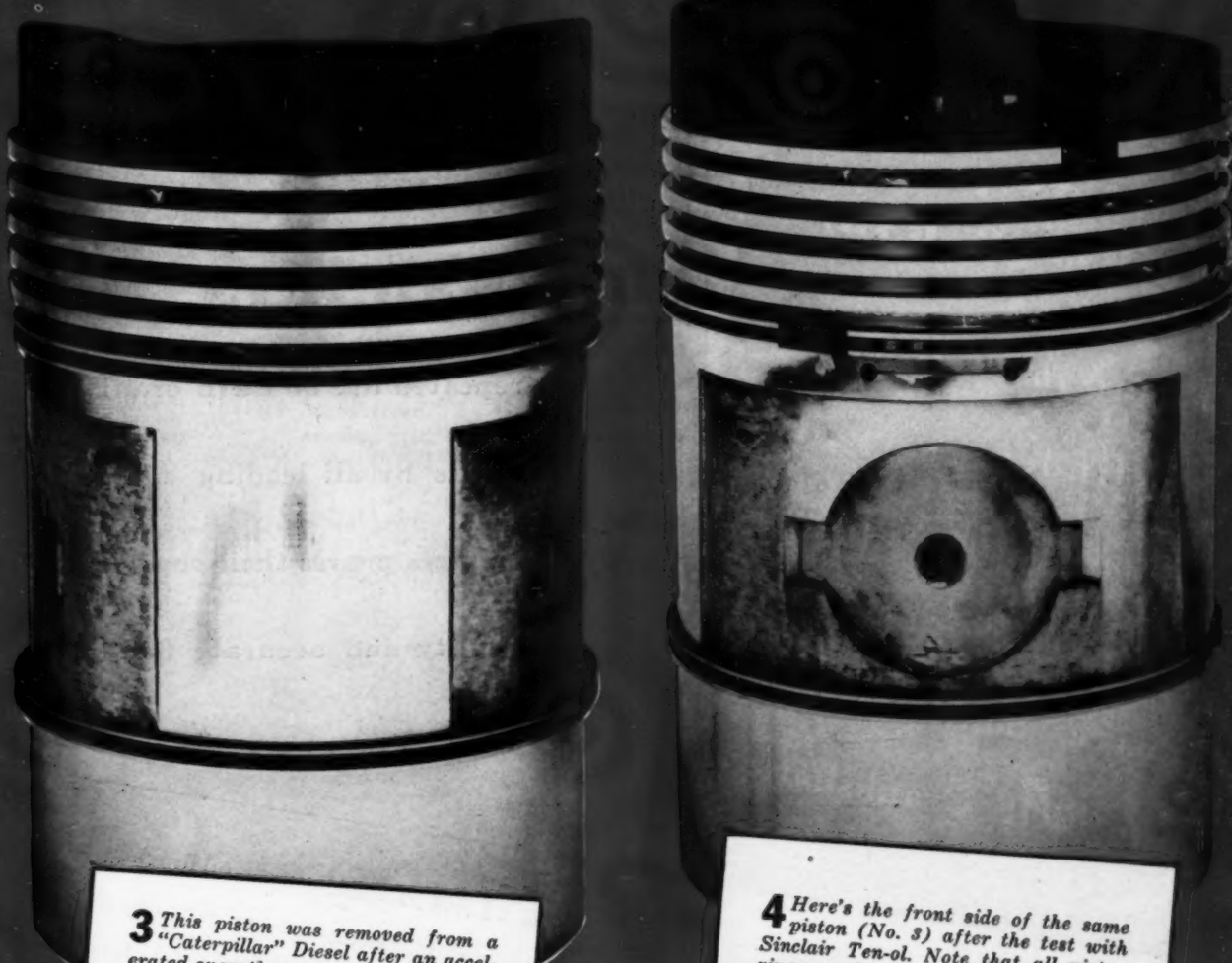
1 *This piston was removed from a "Caterpillar" Diesel engine after an accelerated laboratory operation test. A poor grade of straight mineral oil was used throughout the test. Note the badly stuck rings which caused loss of compression, blow-by and excessive ring wear. Serious oil pumping was also caused by badly plugged oil control rings.*

2 *The finest grade of straight mineral oil was used to lubricate this piston in the same Diesel engine during an accelerated operation test of the same duration as No. 1. Poor piston seal is indicated by signs of excessive blow-by. Note the carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is still excessive.*

service hours with SINCLAIR TEN-OL

taken after exacting laboratory tests. The piston photos have *not been retouched.* Read the captions under each photo—they tell the remarkable story of Sinclair Ten-ol's outstanding superiority. It will mean a tremendous saving in your own Diesel operation.

Sold by your local Sinclair representative.

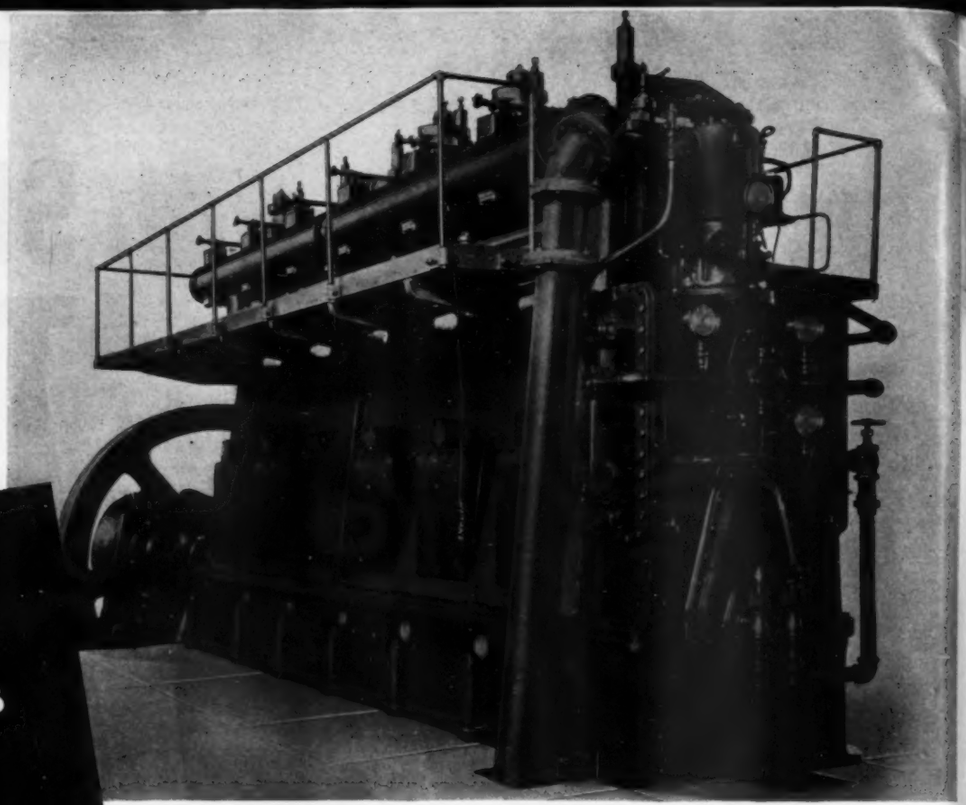


3 *This piston was removed from a "Caterpillar" Diesel after an accelerated operation test* ten times as long *as that of No. 1 and No. 2 on the left. Sinclair Ten-ol lubricated the Diesel throughout the test. Note the absence of ring-sticking, the perfect condition of oil-control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.*

4 *Here's the front side of the same piston (No. 3) after the test with Sinclair Ten-ol. Note that all piston rings are clean and move freely. Experts pronounce this the cleanest, most perfect Diesel lubrication job ever obtained.* Sinclair Ten-ol multiplies Diesel service hours by ten!

Sinclair Ten-ol is recommended as a "New Outstanding Diesel Engine Lubricant" by the Caterpillar Tractor Co. Order Sinclair Ten-ol, Sinclair Diesel fuel and other Sinclair products from your local Sinclair office or write Sinclair Refining Company, 630 Fifth Avenue, New York City.

Copyrighted, 1937, by Sinclair Refining Company (Inc.)



TWO FULTON ENGINES AT PIERRE, SO. DAK.

The two 750 B. H. P.— 6 cylinder, 4 cycle Fulton Engines in the municipal plant at Pierre, South Dakota, use ERIE Crankshafts.

CRANKSHAFTS ... The repeated use of ERIE crankshafts by all leading engine builders proves their superior quality and accurate finish.

WE ALSO MAKE rough and finished connecting rods, piston rods, crossheads, generator and extension shafts. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.

ERIE FORGE COMPANY

ERIE, PENNSYLVANIA

"Eminently Satisfactory in every way" — says John Barrymore

IN CHINA, from whence much oriental wisdom has been absorbed by sea faring men of the Western world, they evolved the axiom: "If you would know the road—ask one who has traveled it." Accepting this truism, an old San Francisco sea captain interested in the purchase of a Diesel engine, wrote to John Barrymore and asked his opinion of the Atlas Diesels installed in his famous yacht "INFANTA."

In asking the opinion of John Barrymore, he chose a man who has certainly traveled the roads of the world and should render a discriminating opinion. Few yachtsmen have cruised so much and so thoroughly enjoyed their boats as has John Barrymore. When he replied to the old San Francisco sea captain, this is what he wrote:

"Your letter of October 8th just received, and I hasten to reply to it, as I am very glad to be able to inform you that the Diesel engines in my yacht 'INFANTA' have been EMINENTLY SATISFACTORY IN EVERY WAY, and my engineer, who is a man of great judgment and experience, says they are the finest engines he has ever handled.

"I wish also to add that the great and consistent courtesy I have experienced from the Atlas Imperial Diesel Engine Co. is an added element in favor of doing business with them. I certainly would not think of installing any other engines than theirs if I were building another boat."

When you select an engine for your boat, profit by the experience of yachtsmen of judgment who can afford to buy the best. So much of the pleasure of the sea depends upon the reliability of your power plant that you cannot afford to experiment. You will choose wisely when you select the old dependable ATLAS DIESEL.

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIFORNIA • MATTOON, ILLINOIS

ATLAS IMPERIAL

Two "Alnor" Pyrometers Protect Diesel Ice Plant

THE two 300 hp. Chicago Pneumatic Diesels recently installed in the Central Ice Company's plant at Brooklyn, N. Y., are each equipped with an "Alnor" Round Pyrometer, flush type, shown at right.

As will be seen from the plant view above, a pyrometer is mounted on the end of the engine, convenient for the operator to easily and quickly check the conditions of the several cylinders.

"Alnor" Pyrometers are made in numerous sizes and styles. Whether an individual pyrometer for each engine is desired or a single pyrometer to serve several engines with the instrument distantly located is preferred, you will find in the "Alnor" line a pyrometer ideally suited for your service.

WRITE FOR COMPLETE CATALOG

ILLINOIS TESTING LABORATORIES, Inc.
423 North LaSalle Street, Chicago, Illinois
Testing Engineers and Manufacturers of "Alnor" and "Price" Pyrometers
The Products of 35 Years' Experience

Use "Alnor" Pyrometers—*The Diesel X-Ray*

SINCE 1866 SPECIALISTS IN CORRECT LUBRICATION

Beginning in 1866...with Hiram B. Everest...the Makers of Gargoyle Lubricants have served Industry longer than any other Oil Company!

Today, Gargoyle Lubricants and Socony-Vacuum Engineering save Millions for Plant Owners!

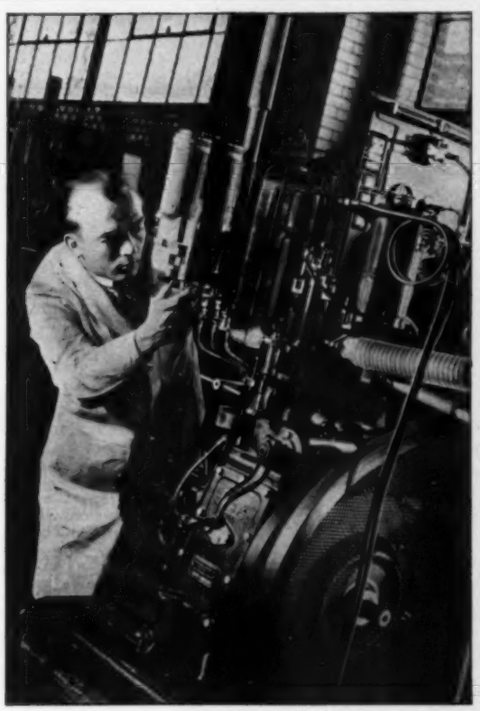
WHEN you do business with Socony-Vacuum, you get something that you can't buy from any other oil company:

Experience... 71 years of making Gargoyle Lubricants provide scientifically correct lubrication.

Socony-Vacuum engineers solve some 25,000 individual lubrication problems every year They help capable plant staffs to curb friction losses and power consumption.. reduce maintenance expense and repair costs... increase machine efficiency and step up production... lower oil bills and make better plant lubrication cost less.

It would be a very timely business move to urge your men to seek the cooperation of Socony-Vacuum engineers.

An organized plant lubrication program, based upon individual requirements, will enable them to do better work.



HOW THIS SPECIALIZED KNOWLEDGE WORKS FOR YOU IN YOUR PLANT:

1. **Curbs friction loss and reduces power consumption.**
2. **Reduces repair, replacement and maintenance expense.**
3. **Steps up machine efficiency for greater production.**
4. **Lowers oil bills to make plant lubrication cost less.**

SOCONY-VACUUM

INDUSTRIAL LUBRICATION

GARGOYLE Lubricants

SAVES MONEY FOR INDUSTRY

71 Years' Lubricating Experience...the Greatest in the Oil Business

HERE—

See the NEW BUDA MODELS at Booth W

Motor Boat Show—January 8-16, 1937

AGAIN Buda leads the way with the finest thing in engines ever offered the boating public—the new size Buda Perfect Pair—the Buda-Lanova "Silver Crown" 6-LDM-691 with Controlled Turbulence Combustion.

This size will be available in true rights and lefts—but more than that, they will be perfectly matched—matched pistons—matched connecting rods—matched and balanced throughout for the smoothest running twin Diesel engine set-up ever made possible. They mean a balanced engine room, a roomier engine room. They mean a new exhilaration in cruising, perfect timing—synchronized power—a coordination that results with true right and left operation.

This engine can be seen in the Buda display at the National Boat Show.

Other Deisel Models

In addition, there is the new 4-LDM-196, a smooth running 4-cylinder unit for the small cruiser or auxiliary and the new 6-LDM-1742—a big fellow—a six that develops 200 H.P.

Here is a range of horsepower to care for every condition from 32 to 200—and all with Buda-Lanova Controlled Combustion advantages that have made Buda Deisels so successful in the prominent boats of '36.

Buda Gasoline Engines

See the Buda Gasoline Engines too,—the same proved dependability, the same heavy duty construction—3 in. crankshafts, five main bearings on 4-cylinder engines and seven on sixes.

Add to that the fact that there are no extras to buy. Buda Gasoline Engines come to you completely equipped.

Horsepowers from 25 to 125 with or without reduction gear.

THE BUDA CO.

Marine Engine Division C

Harvey (Chicago Suburb) Ill.

BUDA SILVER CROWN **MARINE ENGINES**

The New Leader ..IN ITS POWER CLASS

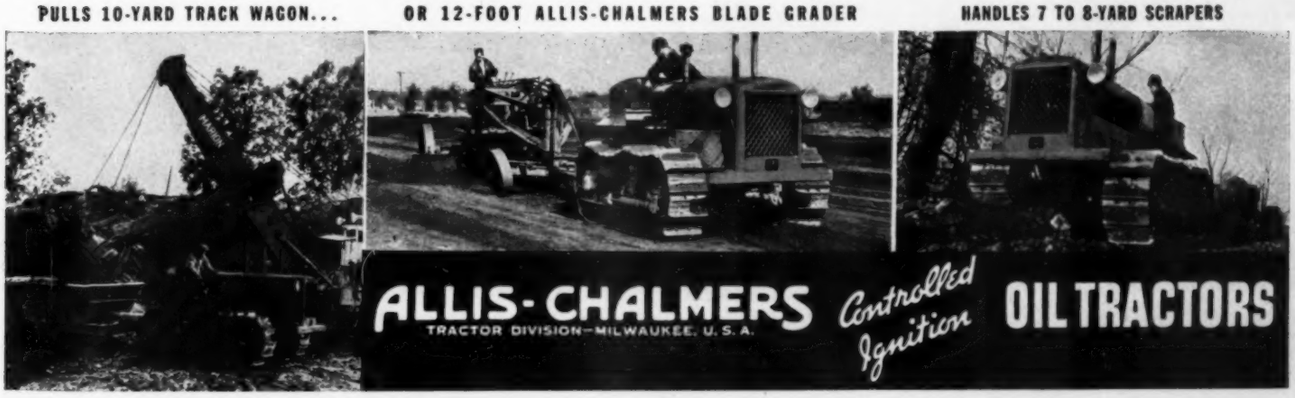
MODEL S-O

CONTROLLED IGNITION OIL TRACTOR

TO MEET THE NEED for a fast, flexible tractor in this particular power class . . . Allis-Chalmers presents the sturdy, fast-stepping Model "S-O." An entirely new tractor—new engine, new transmission, new tracks—all designed to work together; all built to fit the job. Handles 7 to 8-yard scrapers, 12-foot blade grader or 10-yard track wagon. New Constant-Mesh Transmission—you shift gears with the tractor in motion. Five speeds forward—up to 6.37 miles an hour. Operates on low cost Diesel fuel oil—with the exclusive A-C advantage of Controlled Ignition—one of the greatest tractor improvements in years. The "S-O" brings a new kind of tractor performance to its size and price class.

CONTROLLED IGNITION
FIVE SPEEDS FORWARD; ONE REVERSE
DIESEL FUEL OIL ECONOMY
CONSTANT MESH TRANSMISSION
TRUCK-TYPE GEAR SHIFT
ROLLER BEARING TRACKS
CONTROLLED TRACK ALIGNMENT
MORE POWER PER POUND
INSTANT STARTING
UP TO 6.37 MILES AN HOUR

PULLS 10-YARD TRACK WAGON... OR 12-FOOT ALLIS-CHALMERS BLADE GRADER HANDLES 7 TO 8-YARD SCRAPERS



ALLIS-CHALMERS TRACTOR DIVISION—MILWAUKEE, U. S. A. *Controlled Ignition* **OIL TRACTORS**

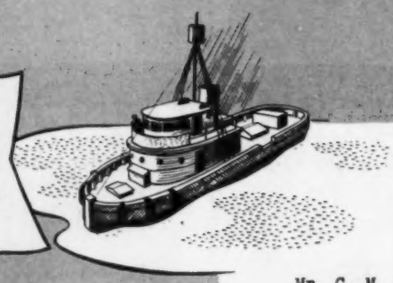
"CLEANED CARBON FROM PISTON RINGS"

"40% LESS OIL CONSUMPTION"

"ADDED 12 REVOLUTIONS PER MINUTE"

"EXHAUST TEMPERATURE LOWERED 39°"

"REDUCED OIL PUMPING 95%"



NASSAU FERTILIZER & OIL COMPANY
Fernandina, Florida

June 20, 1936

Mr. C. M. Bennett,
2789 Riverside Ave.
Jacksonville, Florida

Dear Sir:

I just have to write you regarding the performance of the engine I am running in the boat "SEMINOLE" owned by the Nassau Fertilizer & Oil Company, Fernandina, Florida.

After your examination of this engine, in which you found three rings stuck in each piston, the exhaust ports over half closed, and recommended that we use an S. A. E. No. 20 Ring-free Oil so that we would receive a more rapid cleaning effect, I will confess that I was extremely worried about burning out some of my bearings on such an extremely light oil. As you know, this is an old style 240 HP Fairbanks-Morse full reversible Diesel powering a rather large converted steam tow boat, and now being used in the menhaden fishing business.

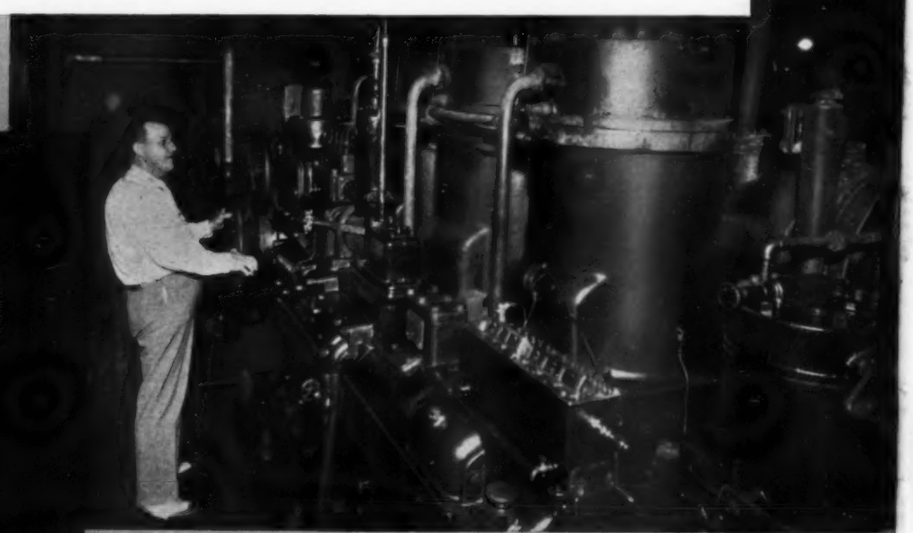
I operated eighty hours on an S. A. E. No. 20 Ring-free Oil as you suggested. At the end of that time I opened my exhaust manifold and found the ports entirely clean of carbon. Placing a bar against the piston rings I found every ring of every piston to be entirely free. As you know from what I told you, our oil wastage from oil being pumped up in the exhaust manifold was as much as six ten-quart buckets in from twelve to fourteen hours of running. That has diminished until now it won't equal more than three quarts. Our oil consumption is less than 60% of what it was formerly. The motor turned up twelve revolutions faster, the exhaust temperatures have lowered 39 degrees and we have had to put a by-pass in the circulating water so that we can maintain 100 degrees temperature on the circulating water. We found that your oil caused the engine to run so smooth that with the ordinary amount of circulating water it ran too cool.

I have had a lot of favors done me in my life, but in all the years I have run Diesel motors, nobody has ever been as kind to me as you were when you sold my employer Ring-free Oil.

Your friend,

John Graham

John Graham, Chief Engineer,
Boat "SEMINOLE,"
Fernandina, Florida.



MACMILLAN RING-FREE MOTOR OIL

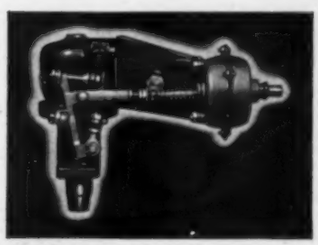
1. GREATER FILM STRENGTH
2. HIGHER HEAT RESISTANCE
3. LONGER CLING TO METAL
4. FASTER PENETRATION
5. REMOVES HARD CARBON
6. IS NOT CORROSIVE

Diesels are diesels whether they sail the seas, pull trains or power industrial plants. The finer the diesel... the more it deserves an oil that will not form carbon or stick piston rings. Let the Macmillan Man prove what this oil will do for your diesel. **Macmillan Petroleum Corporation, 530 West Sixth Street, Los Angeles, Cal., or El Dorado, Ark.**

BENDIX

Bendix-Holmes Automatic Steerer and Steering Remote Control

Bendix Marine Products make *any* boat a *better* boat!



Vacuum Control for Governor-controlled Throttles

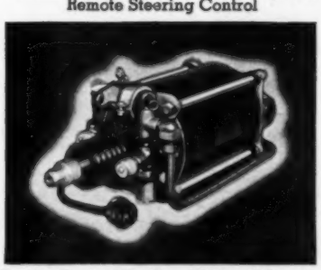
EVERY power-driven watercraft—from ocean-going cruiser to the fisherman's skiff or yachtsman's dinghy—can be bettered by Bendix Marine Products.

Modern, air-cooled and electric outboard motors! Full-automatic steering, with remote control to anywhere aboard! Power gear shifting, controlled by a finger's touch from anywhere aboard! Spark and throttle actuation at a touch of the finger on the bridge or elsewhere, 'round a dozen "corners" without backlash or lost motion! Flexible exhaust line tubing, vastly more efficient, more sightly, than rigid piping! Famous Bendix Drive, for push-button cranking, with or without full-automatic "stall-proof" starting! Engine starting equipment that asks no odds of sea or sky! Ship controls that are standard everywhere!

Bendix builds all this, and more, for seafaring folks. By and large, it costs no more than second-choice equipment. Particular sailors by thousands demand it. Send the coupon for literature.

Pedestal for Bridge Controls and *(rear)* Remote Steering Control

Hydraulic Throttle Actuator



Bendix Electro-Vac Gear Shift and Remote Control

Bendix Cory-Kent Clear View Screen

Bendix Drive and Bendix Startix—*Automatic "Stall-Proof" Starting*

Zenith Fuel Filter

Bendix Flexible Exhaust Tubing

SEND THIS COUPON FOR FULL DETAILS ON ANY BENDIX PRODUCT

BENDIX MARINE PRODUCTS COMPANY
(Subsidiary of Bendix Aviation Corporation)
493 Bendix Drive, South Bend, Indiana

Please send complete data on the Bendix Marine Products checked at right.

Name .....

Address .....

City ..... State .....

Type of Vessel, or Nature of Business .....

- ☐ Bendix-Holmes Automatic Steerer and Steering Remote Control
- ☐ Pedestal for Bridge Controls
- ☐ Bendix Electro-Vac Gear Shift and Remote Control
- ☐ Bendix Drive
- ☐ Bendix Startix
- ☐ Vacuum Control for Governor-controlled Throttles
- ☐ Hydraulic Throttle Actuator
- ☐ Bendix Cory-Kent Clear View Screen
- ☐ Zenith Fuel Filter
- ☐ Bendix Flexible Exhaust Tubing
- ☐ Vacuum Control

THER
NEER
ICKS
SATCO

THE trusty, ether-breathing 1 you pictured above was built to pass on Electric A Motive trains pass on Electric "Pitchlights" Thus another line freights the way Diesel motor line freights the way as a power that protects the way natural freight transportation by

The bearings in the twin Diesels in this handsome new Beardstown of this type have rolled u powered locomotives with pro the new trend in passenger trai tion by rail.

Your consideration of our Satco bearings is asked not because they recent development, but simply b they are different from other whit alloy bearings — we know them t attention because we honestly b ery will do a better job on all ty Diesels.

Diesels in the oil fields, too, develop smooth, steady, economical power

SATCO LINED BEARINGS

JUST as surely as the Diesel engine is progressing into all fields where dependable, economical power is essential, so too, are Satco-lined bearings rapidly becoming standard equipment on Diesels designed for all types of work. Diesels' bearings have long since proved their ability to stand up under heavy loads, high operating speeds, and extraordinary stresses and strains.

The power plant pictured above is one of two 2,250 hp. 6-cylinder Diesel engines built by National-Superior Diesel Engines of Springfield, Ohio, to drive generators for electric drilling rigs in the Cities Service City oil fields. The rig is the largest of the Diesels in the deep oil fields of Springfield.

If you are building or using Diesels, it will pay you to get all the facts about our Satco metal bearings.

*A patented alloy manufactured by National Lead Co.

AMERICAN BEARING CORPO

AFFILIATED WITH NATIONAL LEAD COMP

INDIANAPOLIS INDIANA

AMERICAN BEARING CORPORATION

INDIANAPOLIS INDIANA

AFFILIATED WITH NATIONAL LEAD COMPANY

TO THE MEN "FROM MISSO

IN practically every case where Diesels have been installed to replace power plants, they have sold themselves by superior performance.

In practically every case where Satco* bearings have been installed in Dies they have sold themselves by superior performance.

Just as unseen and unsung as the men who work the hoists and lights and pro steps production, Satco bearings, too, contribute mightily, behind the scen Diesel performance.

You men "from Missouri" who want to be shown hard facts and cold fig Satco bearings have performed in tough jobs have but to drop us a line.

*A patented alloy manufactured by National Lead Co. Trade mark registered.

AMERICAN BEARING CORP

Affiliated with National Lead Compa

INDIANAPOLIS INDIA

TS, PLEAS

said that these words are the one today's rail transport and today's ers placed in service today the Union ington are dated today not merely ance but also in performance. Their rander's demand for speed, comfort,

ny factors that has contributed much e performance of these streamliners is e. And one of the factors that has con-

bearing metal. It has been the privilege of America Bearing Corporation to work with Diesel builders i designing and fabricating Satco-lined bearings for main of the Diesels used in the new streamliners.

Satco-lined bearings stand the gaff. This modern alloy has a high melting and softening point. It withstands heavy pressures and unyielding stresses. It has ever quality needed to meet today's power production requirements. Let us help you with Satco bearing problems. We will be glad to furnish complete information

*A patented alloy manufactured by National Lead Company. Trade-Mark registered.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS INDIANA

DAILY the Diesel engine gives a convincing demonstration of its versatility. Adjust and adapt Diesel's economical performance becomes more wi known.

Here we see a ship sailing the high seas; t we find a tractor battling through a swamp; on highways, heavy trucks carrying heavier paylo on the rails, swift new trains giving the trave public a new deal — all powered by Diesel engi

It has been the job of American Bearing Corp tion to help insure steady, trouble-free operation

*A patented alloy manufactured by National Lead Company Trademark Registered

AMERICAN BEA

Affiliated with

INDIANAPOLIS

BUILT to DELIVER the GOODS

NATIONAL-SUPERIOR DIESELS are designed and built to do a specific job . . . to deliver depend able, economical power. Engineers of the types shown above are delivering the goods in the textile mill of the Salem Mfg. Co., Sarnesboro, N. C., for the Gen. Generative Lime & Quarry Co., Mosher, Mo., for Price Bros. Co., Ann Arbor, Mich., and for the R. F. Hoffman Construction Co., Buffalo, N. Y.

Our Satco - lined crankpin bearings are doing their bit toward helping these Diesels deliver needed trouble-free power. This remarkable alloy embodies all the desirable features of a bearing metal needed to meet today's power production demands. Pulverant resistance to crushing stresses, low frictional coefficient, relatively high melting point, and toughness and lubricatum, produces a lining that will do the job it is intended to do . . . that will deliver the goods.

Satco metal, in the hands of our designers and fabricators, produces a lining that will do the job it is intended to do . . . that will deliver the goods.

*A patented alloy manufactured by National Lead Co. Trade mark registered.

AMERICAN BEARING CORPORATION

Affiliated with National Lead Company

INDIANAPOLIS INDIANA

Growth

GROWTH is not a product of chance . . . in the race field or in the Diesel field. The Diesel has succeeded because it was brought along carefully and scientifically. It has reached a point where it can demonstrate its capacity to handle all sorts of power jobs effectively.

In manufacturing Diesel plants the country over, locomotive and stationary, you will fi Satco* lined bearings of our manufacture. Diesel builders and operators have learned th can depend upon Satco metal to stand up under loads and speeds and stresses that w cause less sturdy alloys to fatigue or to hamper the growth of your Diesel business, w

If bearing problems threaten to hamper the growth of your Diesel business, we welcome a chance to suggest solutions.

*A patented alloy manufactured by National Lead Company. Trade Mark registered.

AMERICAN BEARING CORPORAT

Affiliated with National Lead Company

INDIANAPOLIS INDIANA

NORDBERG USES SATCO BEARINGS, TOO

Two Nordberg Diesels—one 500 hp. 4-cycle, the other 750 hp., 4-cycle—operating in a cutter oil mill. American Bearing Corporation furnished the Satco-lined bearings.

"ACHILLES HEEL"

A DIESEL may represent the last word in engineering perfection but if the bearings don't measure up there's sure to be a postscript . . . in the form of lay-ups or shut-downs due to early bearing failures. Main and crankshaft bearings are the "Achilles heels" of many an otherwise well-designed engine. Leading Diesel makers and users are standardizing on Satco* lined bearings as insurance against the costly interruptions that can be caused by premature bearing failure.

Satco metal was developed to meet the needs of modern power production. Linings made of this alloy have exceptional resistance to crushing stresses, a low frictional coefficient and a relatively high melting and softening point. Proof of these qualities may be had by examining the service records of numerous important Satco-equipped Diesel installations around the country.

We invite your inquiries on all bearing problems.

*A patented alloy manufactured by National Lead Company. Trademark registered.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS INDIANA

BEARINGS ARE BOUGHT ON THE BASIS OF PERFORMANCE

WHAT bearings DO is of vastly greater importance than wh
COST. One premature failure can easily cost more than the pr
deeds of bearing installations. Our bearings are designed, fab
stalled and sold with
free
spective—to give honest
ings for Diesel engines for all
ers and operators. We solicit

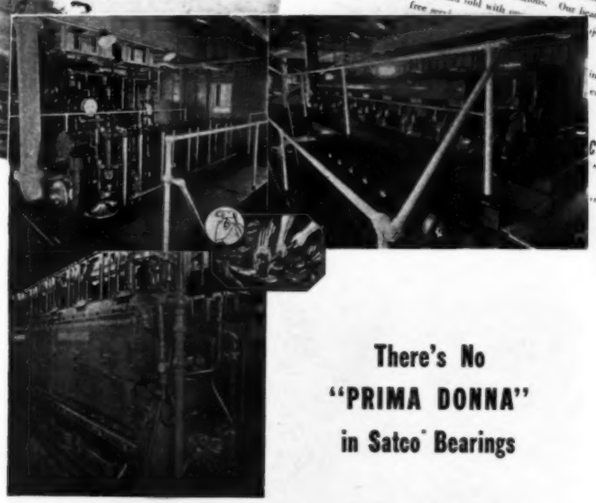
CORPORATION
AD COMPANY
DIANA

a QUOTE from a man who knows . . .

"Despite the inherent features of a Diesel, as compared with a gasoline engine, we have had absolutely no trouble with the main crank-shaft or connecting rod bearings." — C. G. GURLEY,* Burlington Lines.

This is a meaningful tribute both to Satco-lined and to American Bearings. Competition manufacturer because the Western Diesel engines in the fast Burlington "Zephyrs" now operating, are equipped with Satco-lined American bearings. And the Western-Diesels now under construction for the new "Zephyrs" will be equipped with Satco-lined American bearings. Northern Pacific will be equipped with Satco-lined American bearings in Diesels of all types have given uniform satisfaction. Satco-lined bearings in Diesels of all

AMERICAN BEARING CORPORATION
AFFILIATED WITH NATIONAL LEAD COMPANY
INDIANAPOLIS CENTRIFUGAL FORCE INDIANA



There's No "PRIMA DONNA" in Satco* Bearings

SATCO-LINED bearings have never sought the easy jobs in industry . . . and have never side-stepped the tough ones. If there were any "quit," any temperament, in Satco it would have showed up long ago. In the Diesel field, in particular, it has been our job to design and fabricate Satco bearings for many kinds of power application — from small, fast, light-weight engines to big, heavy power plants like the one pictured here. Satco linings have stayed on the job long after the "prima donnas" have called it a day.

Worthington Pump & Machinery Corporation wished to avoid the risk of premature bearing failure when they built the above engine for the McWilliams dredge "Natchez"...so Satco-lined bearings were installed. This Diesel, Worthington's largest, is an 8-cylinder, 4-cycle engine, 16" x 20", delivering 1000 horsepower at 327 rpm. It is operating at Bronx Bridge, Louisiana.

If you are building or operating Diesels, let us furnish some eye-opening facts about Satco-lined bearings.

*A patented alloy manufactured by National Lead Co. Trade-mark registered.

AMERICAN BEARING CORPORATION
AFFILIATED WITH NATIONAL LEAD COMPANY
INDIANAPOLIS CENTRIFUGAL FORCE INDIANA

FIXIN' FRICTION . . .

FRICTION wins on power enemy number one with most engineers. Its effect can, of course, be minimized by proper balance and lubrication. Bearing design and construction, too, play a leading role in fixin' friction.

Satco* metal has proved beyond question its ability to "take it" under all sorts of operating conditions. It possesses a low frictional coefficient, a relatively high melting and softening point and extreme toughness and resistance to deformation. These qualities, first demonstrated in the laboratory, have been borne out conclusively by numerous Satco bearing installations around the country. Write for complete information about these jobs.

*A patented alloy manufactured by National Lead Company. Trade-mark registered.

AMERICAN BEARING CORPORATION
Affiliated with National Lead Company
INDIANAPOLIS CENTRIFUGAL FORCE INDIANA

SATCO* TELLS THE WORLD

. . . . the Diesel world . . . . that it has what it takes to give dependable bearing service — everywhere, everytime, in every type of Diesel installation. A Satco-lined bearing has a low frictional co-efficient, exceptional resistance to crushing stresses and a relatively high melting and softening point.

American Bearing Corporation has what it takes in the way of designing and manufacturing experience, to lick that Diesel bearing problem you are wrestling with. Write us.

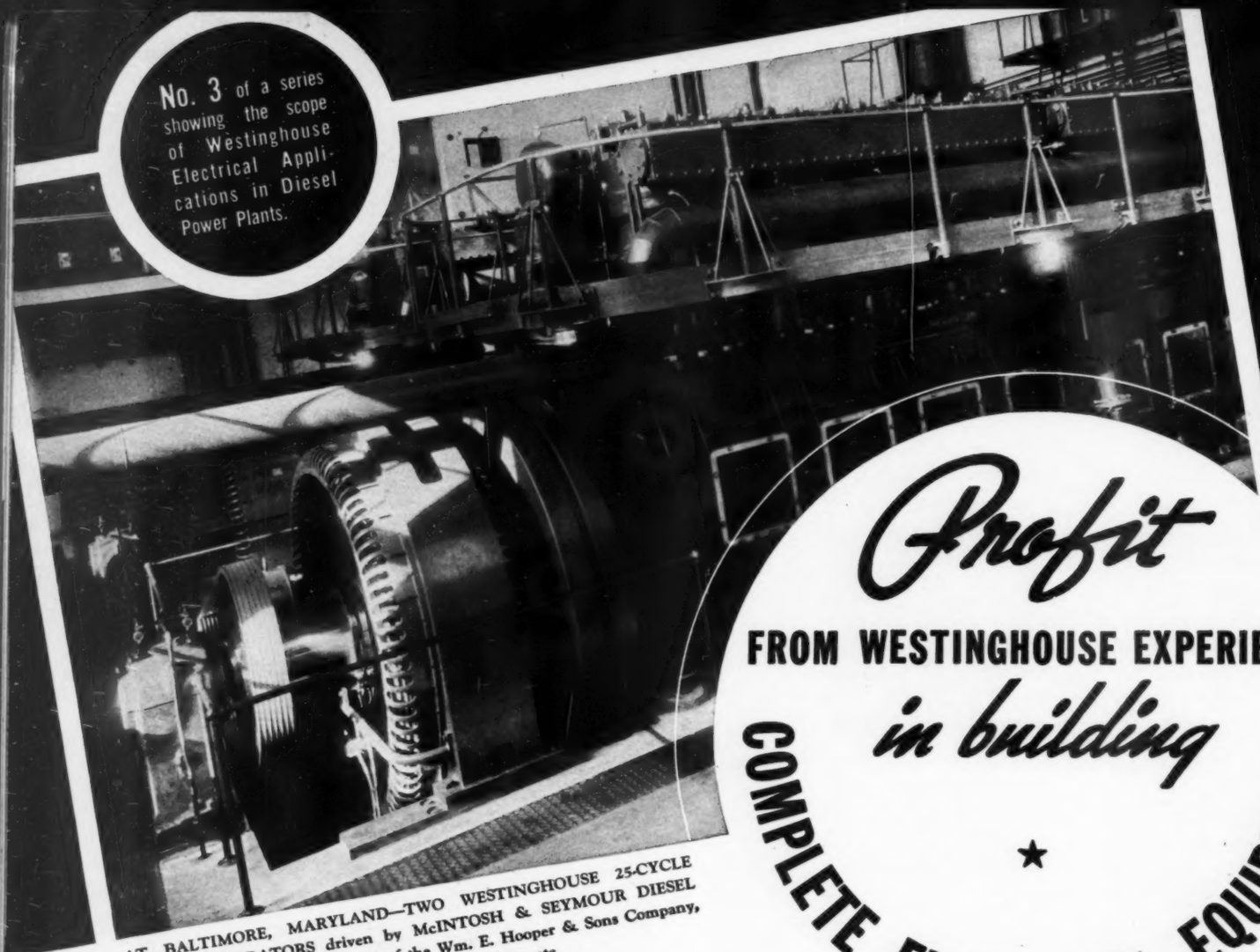
***A patented alloy manufactured by National Lead Company. Trade-mark registered.**

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS CENTRIFUGAL American Bearings FORCE INDIANA

No. 3 of a series showing the scope of Westinghouse Electrical Applications in Diesel Power Plants.



AT BALTIMORE, MARYLAND—TWO WESTINGHOUSE 25-CYCLE ENGINE-GENERATORS driven by McINTOSH & SEYMOUR DIESEL ENGINES . . . in the power plant of the Wm. E. Hooper & Sons Company, manufacturers of cordage, webbing, duck, canvas bags, etc.

Profit FROM WESTINGHOUSE EXPERIENCE *in building* COMPLETE ELECTRICAL EQUIPMENT

★

★ You can insure *a maximum profit* from your Diesel power plant installation by availing yourself of *Westinghouse experience in building a complete line of electrical equipment.*

That experience extends back over 50 years to the early beginnings of the electrical industry. It has proceeded, step by step, as need arose, from one electrical application to another. It has produced combinations of *matched electrical apparatus* for almost every type of complete electrical installation . . . with each piece of apparatus designed and made to perform its proper part in relation to the whole.

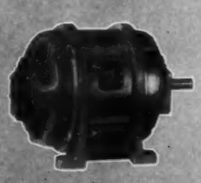
In the field of Diesel power, this means generators, exciters, motors, switchboard accessories and other auxiliary equipment adapted specifically to the requirements of Diesel engines . . . to provide the extra dividend which *matched performance* always pays. J 10013

Insist ON WESTINGHOUSE FOR PROFIT

Wherever you are and whatever your specific requirements may be, successful installation experience proves that you can profit by insisting on Westinghouse for everything electrical.

ES GENERATORS—Especially designed for lifetime operation in Diesel Service, with these extra values: *Solid Steel Rotor*, to withstand severest stresses under all conditions. *Protection against Shut-downs*, insured by exclusive high frequency pre-testing. *Positive Ventilation*, for cool running and long life.

EXCITERS—Either direct-connected or belt-driven, as required.



MOTORS—With dual-protected windings, rigid cast frames, and sealed-sleeve bearings . . . for driving compressors and other auxiliaries.

COMPLETE SWITCHBOARD ACCESSORIES—For every requirement: instruments, instrument transformers, relays, switches, circuit breakers.

Westinghouse

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE

ENGINE-DRIVEN GENERATORS AND ELECTRICAL AUXILIARIES

THE "SYOSSET" COMES HOME . . . ICE OR NO ICE!

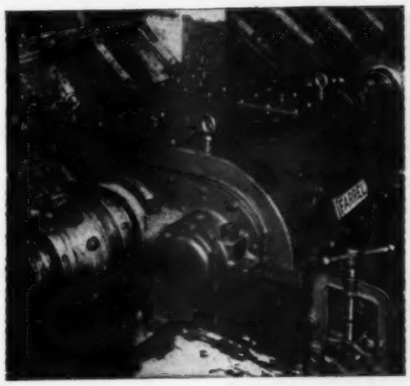
THE havoc wrought by an unusually early freeze in the New York State Barge Canal on November 30, 1936, with its resultant damage to equipment and loss in operating revenues, has been well covered by the Eastern daily papers.

The last report shows a record number of barges frozen in for the winter, all of which were attempting to make one more trip before ending the season and tying up in home ports. The statement, quoted below, of Captain Townsend, owner of the Diesel-geared tug *Syosset*, is eloquent proof that Farrel reduction gears have what it takes for marine service.

Regular schedules mean regular income to a tug boat and both are old stories to the *Syosset*. Powered by a Superior Diesel engine driving through a Farrel reduction gear, the *Syosset* "gets there and back again" on schedule, regardless of weather or water conditions.

Through the use of Farrel reduction gears for marine drive it is possible to employ a relatively lighter and higher speed Diesel engine without sacrificing proper propeller speed. This results directly in reduced engine room space for the required power and increased maneuverability due to the larger wheel. The ultimate and most important results of these combinations are *lower initial and operating costs plus increased earning power.*

It will pay you to investigate the Farrel reduction gear drive when considering the installation of a marine Diesel engine.



The Farrel Duplex Straight Line Reduction Gear Unit installed in the tug *Syosset*.

UNE, TUESDAY, DEC

eant

Ice Threatens 150 Ships Still In Barge Canal

Waterway Officially Shut but Many Delayed by Gales and Zero Weather

Lake Oneida Is Frozen

With the official fall closing of the State Barge Canal last night, shippers were working feverishly to clear approximately 150 vessels, threatened by ice and zero weather. Harvey O. Schermerhorn, Superintendent of Canals and Waterways, reported in Albany that state-owned tugs, limited in number, were being aided by all privately owned tugs available in an attempt to clear a path for several large [illegible] which were icebound in the [illegible] of the canal.

[illegible] o the Michigan who returned yesy inspection trip orted that ice six al lock walls and had prevented e Oneida. He e conditions anal as far as ized the un- "the worst

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Winter Traps Late Barges in Canal at Utica

Cabin Families Give Up New York Christmas and Get Ready to 'Hibernate'

Record 300 Marooned

Fleets' Characters 'Mix' in World of Their Own

By Sanderson Vanderbilt

A Staff Correspondent

UTICA, N. Y., Dec. 6—As dawn broke over this snow-encrusted city today twenty-five heavily loaded New York-bound barges ground to a standstill beside the banks of the New York State Barge Canal as their captains, after a week of hope and freezing toil, surrendered to the ice and resigned themselves to passing the winter here. Numbed with cold and the appalling realization that they have been trapped until next April, the stoopshouldered bargemen made their vessels fast, and then, leaving their wives and children in the cramped and stuffy cabins they call home, shuffled ashore across the ice to the office operating Lock H-L.

There they learned that theirs were the last of 300 barges between Lake Oneida and the Hudson to give up struggling against the hopeless odds of a premature cold wave that has marooned more vessels in the canal this winter than in any previous year in the memory of local boatmen.

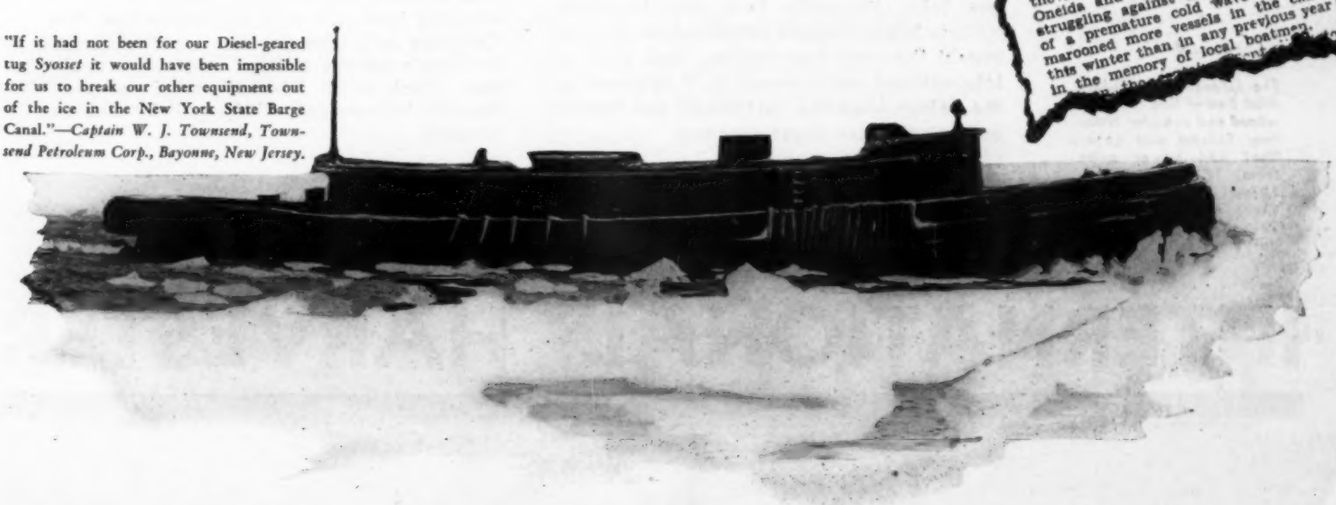
From New York Herald Tribune

FARREL-BIRMINGHAM COMPANY, Inc.

385 VULCAN STREET, BUFFALO, N. Y.

NEW YORK; 79 WALL STREET **LOS ANGELES: 2026 SANTA FE AVE.**

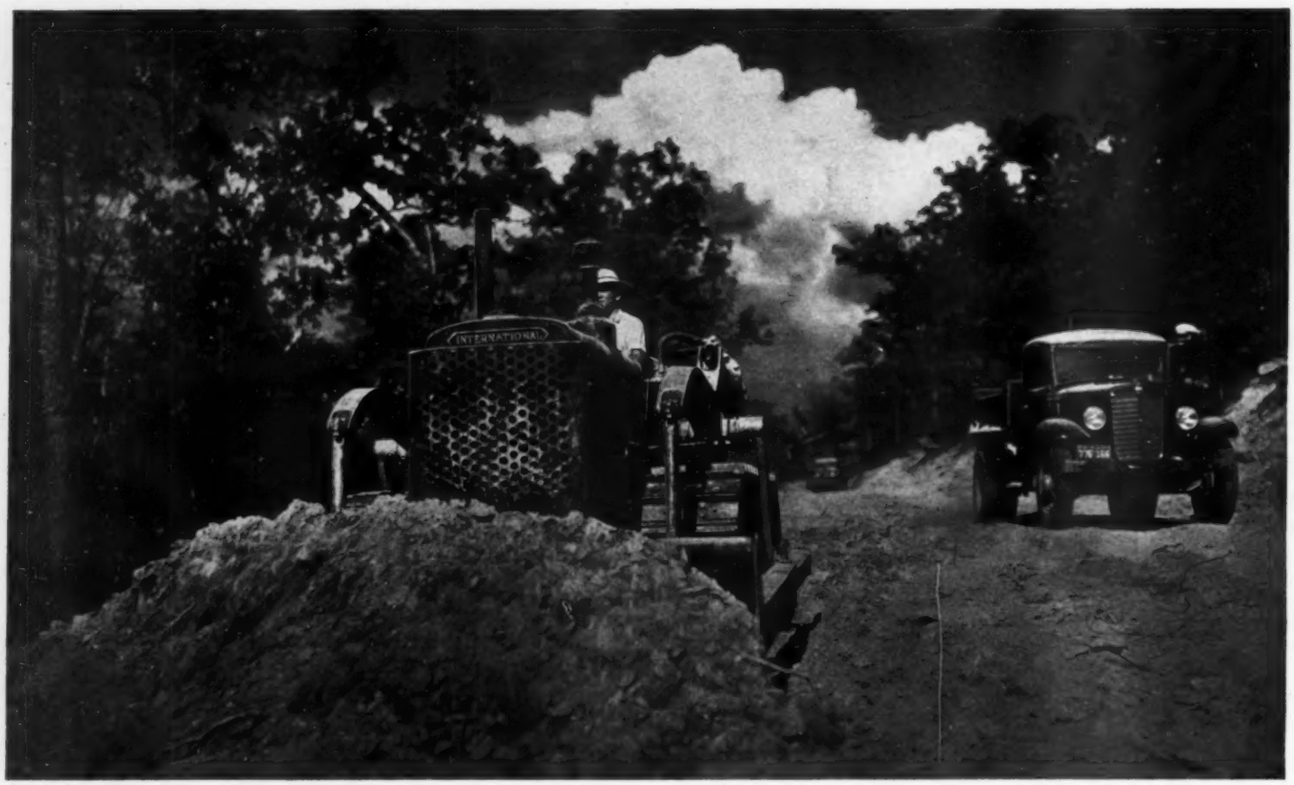
"If it had not been for our Diesel-geared tug *Syosset* it would have been impossible for us to break our other equipment out of the ice in the New York State Barge Canal."—*Captain W. J. Townsend, Townsend Petroleum Corp., Bayonne, New Jersey.*



Make Use of the Industrial Experience of

INTERNATIONAL HARVESTER

When There's a Power Problem to Be Solved



ABOVE: *An International TD-40 Diesel TracTracTor making the dirt move fast on a road project in Arkansas. At the right of the TracTracTor and in the background are International Trucks, favorites throughout the road-building and construction industries.*

●

The International Industrial Power line includes wheel and crawler tractors (Diesel and gasoline) and power units from 12 to 100 hp. (Diesel and gasoline). There are engines from 1½ to 5 hp. for light-duty service.

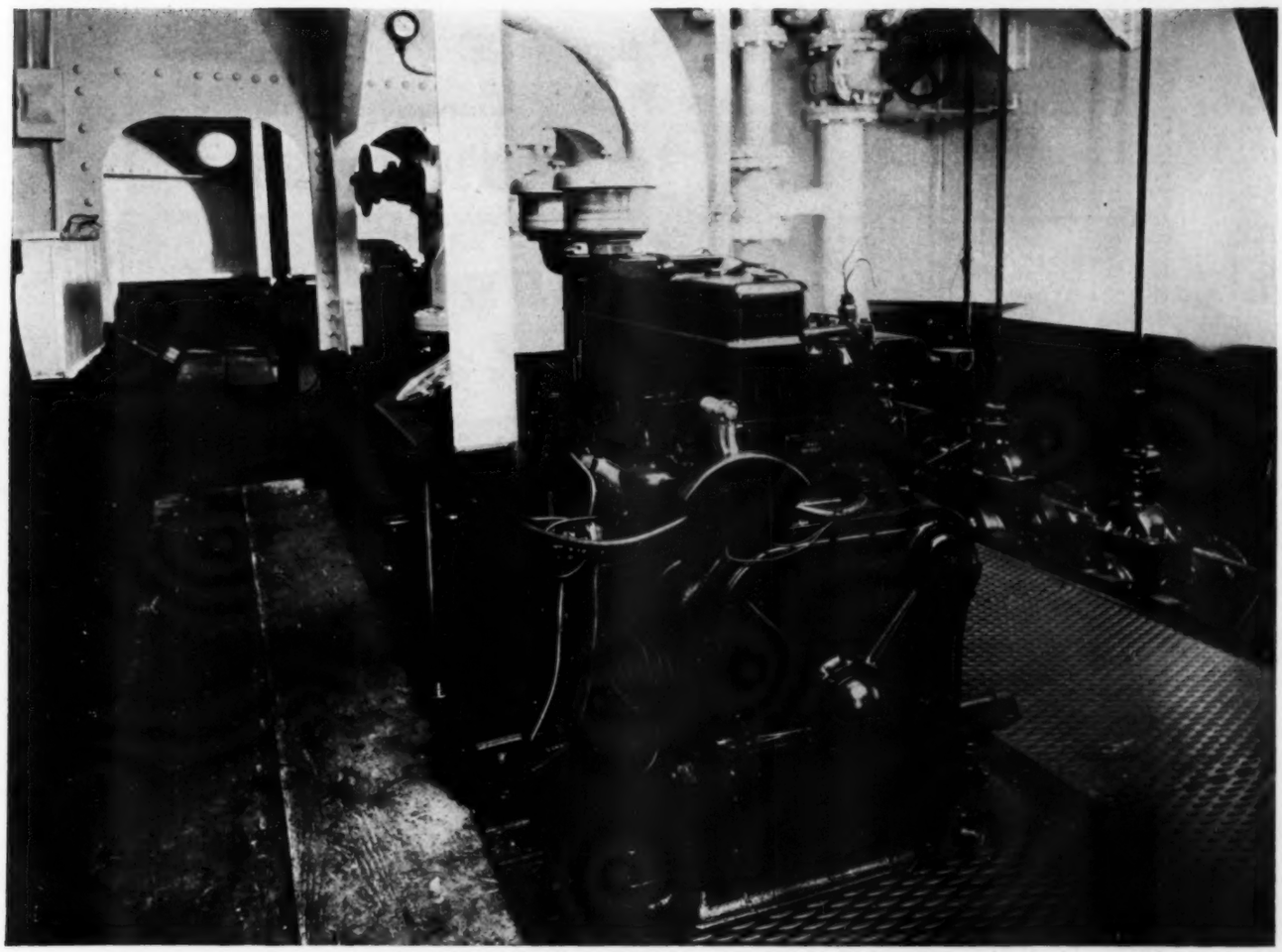
YOUR most reliable guide when you buy industrial tractors and power units is the opinion of users as to *International against the field.* Trust the men who have put this equipment through its paces to give you the real lowdown. Then you will have a good idea of what International Power can do on your jobs. No matter how tough the work, if it's in International's power range, you can expect the utmost in results. And, good as International performance is, it becomes all the better when the cost sheets are figured and you find out about economy.

If your work calls for powerful crawler or wheel tractors, small tractors for cramped areas, fixed power units, or small engines — call on a Company-owned branch, or authorized industrial dealer, in the International Harvester sales-service organization.

Vast numbers of successful installations of International Tractors and Power Units, all over the land, are your guarantee that this Company will give you the soundest, most profitable answer to your own power problem. Cash in on International *Experience.* Specific information will be sent by mail on request.

INTERNATIONAL HARVESTER COMPANY
606 So. Michigan Ave. *(Incorporated)* Chicago, Illinois

INTERNATIONAL HARVESTER



Superior Model IA-6 Diesel Engine driving cargo pumps on oil barge owned by The Texas Company, Los Angeles, California

Regardless of the requirement, a Superior Diesel has those necessary qualities of rugged dependability, simplicity and accessibleness that meet the most severe operating conditions.

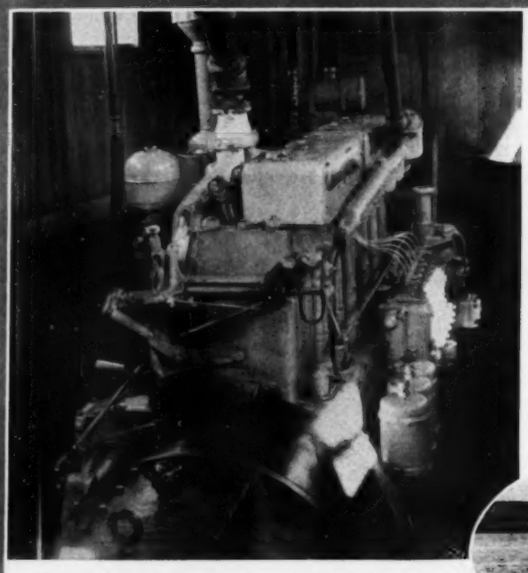
The unhesitating acceptance of Superior Diesel Engines for the "tough jobs" is their best recommendation to those requiring reliable and economical operation.

Sizes range from 20 to 150 H. P.

THE NATIONAL SUPPLY COMPANY
OF DELAWARE
OTTO ENGINE DIVISION

LOS ANGELES, CALIFORNIA — HOLMESBURG, PHILADELPHIA, PA.

Superior DIESELS



FORWARD AND REVERSE *at the Same Speeds...* WITH FINGERTIP CONTROL

Tugboat **Fafnir,** *used for seismograph work in Galveston Bay, has Caterpillar Diesel Engine with Twin Disc Reverse and Reduction Gear Unit.*

● The *Fafnir*, a 42 x 10 ft. tugboat, owned by Captain H. V. Pond of Laporte, Texas, is used to tow a drilling barge used in oil exploration work in Galveston Bay.

Recently the Gulf Tractor & Equipment Co. installed a six-cylinder model 13000 Caterpillar Diesel Engine equipped with a MG-160 Twin Disc Reverse and Reduction Gear Unit which turns a 42-in. diameter, 32-in. pitch, 3-blade propeller at 2 to 1 ratio, giving 425 rpm on the propeller.

Because the Twin Disc Reverse Gear Unit permits a reverse speed that is 100 per cent that of the forward speed, the tug has handled with so much greater ease and accuracy that it has been possible to accomplish twice as much work as before.

The new equipment has been in operation since last April. The tug has been working with the barge fourteen hours a day. Yet there has been no time out, and no expense for maintenance. A real record!

MG-160 "Series" Reverse and Reduction Gear Units are rated 160 hp. at 1200 rpm; standard gear ratios are 2:1 or 3:1. Write for Bulletin 103.

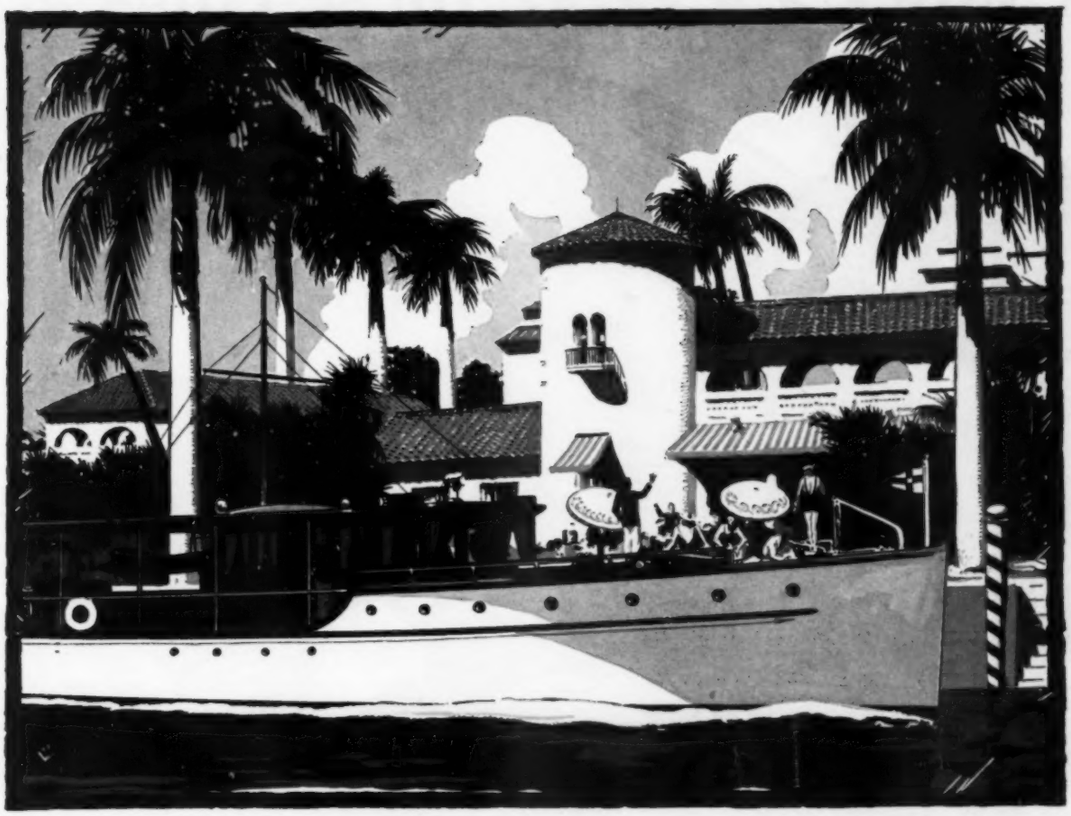
TWIN DISC CLUTCH COMPANY
1345 RACINE STREET, RACINE, WISCONSIN

TWIN DISC CLUTCHES

AT THE NEW YORK BOAT SHOW . . . VISIT BOOTH 45, THIRD FLOOR

MARINE REVERSE AND REDUCTION GEARS

HERCULES POWER CHOSEN BY LEADING MARINE ENGINE MANUFACTURERS



While Hercules does not make complete marine power plants, Hercules Engines are used today by many leading marine-engine manufacturers. The manufacturers who choose Hercules Engines—either gasoline or Diesel—select them for compact design, dependability and long life. Marine engines must have those qualities—must be relied upon in fair weather or foul. And those qualities result from over twenty years' experience in designing and building heavy-duty engines for every purpose. This experience is at the service of commercial and pleasure boat as well as marine-engine builders.

Hercules Marine Diesel Engines supplied by Kermath Manufacturing Company, Detroit, Michigan

HERCULES DIESEL ENGINES

HERCULES MOTORS CORPORATION, CANTON, OHIO

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

"THEY were right . . . look how *clean* these rings are"

Clean rings, free from carbon and gummy deposits prove the value of Algol and Ursa Oils in maintaining engine efficiency.

THOSE who have had experience with Texaco Diesel Oils *know!* You, can be absolutely sure of cleaner piston rings with Texaco Algol and Ursa Oils. They are made from selected crude . . . harmful carbon and gum forming elements are removed. They are all lubricant.

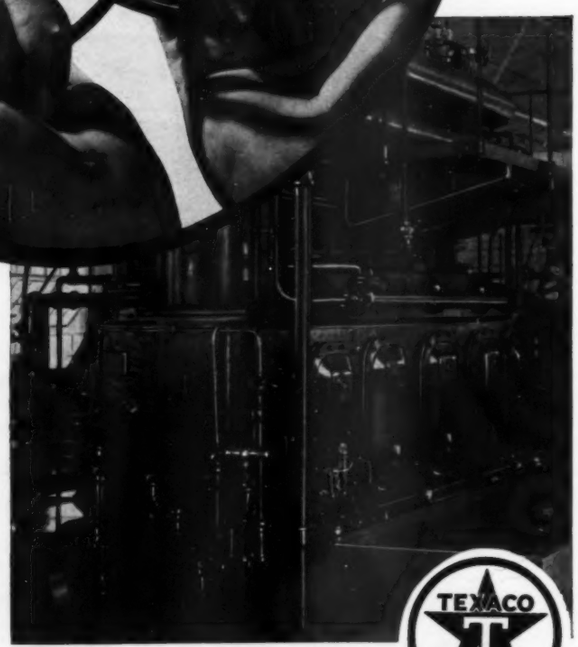
The exceptional quality in these oils is widely recognized . . . *More Diesels are lubricated with Texaco Algol and Ursa Oils than with any other brand.*

Put *your* Diesel lubrication up to Texaco. Find out why these oils give you greater freedom from stuck rings, blow-by, and hard carbon . . . why you can be sure of fuel savings and longer continuous operation between inspections.

A Texaco representative will be glad to provide practical engineering service to prove the economy of Texaco Products.

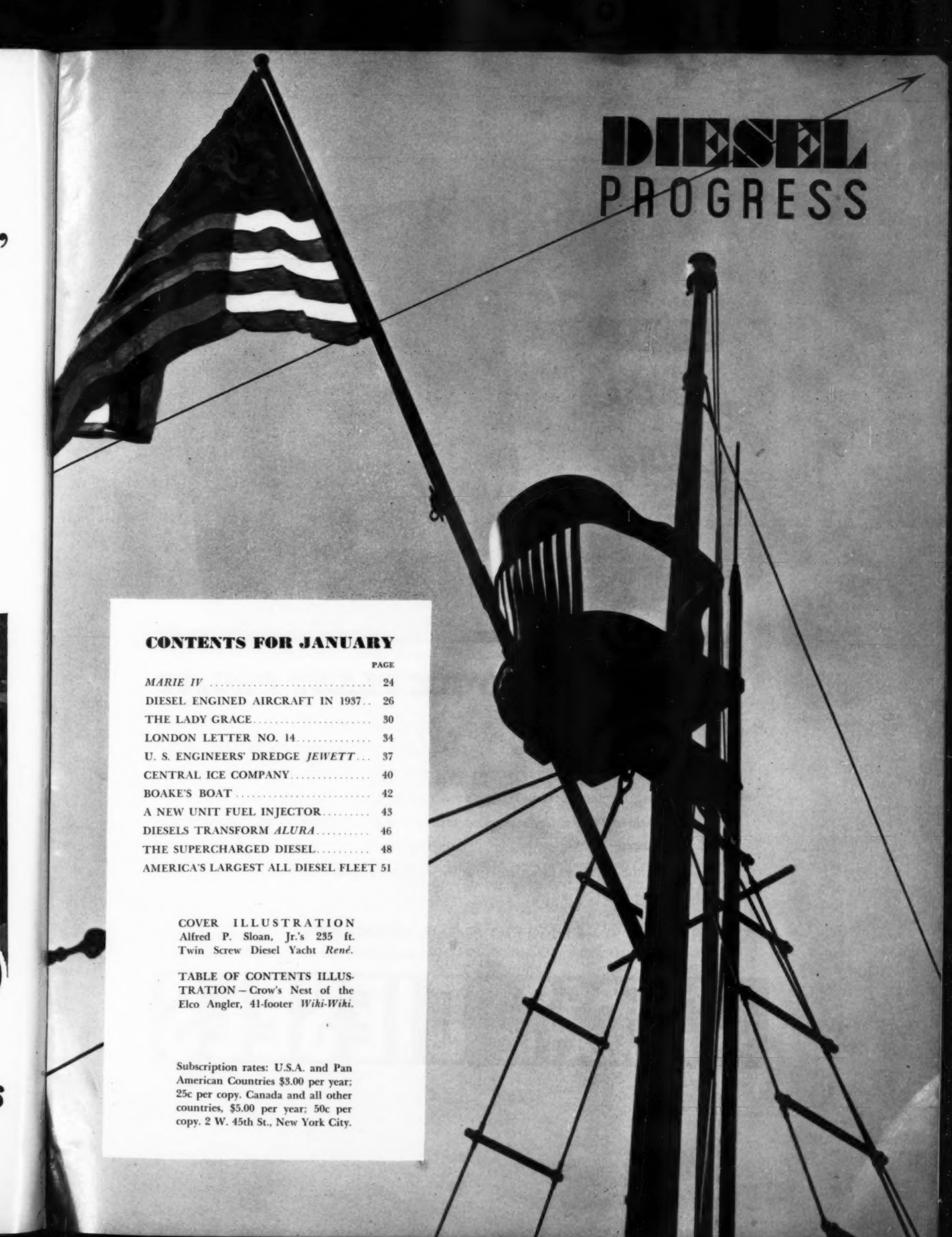
THE TEXAS COMPANY • 135 East 42nd Street, New York City

Nation-wide distribution facilities assure prompt delivery



The purity of the oil you use for Diesel lubrication is all-important in keeping your engines at maximum power output, reducing the need for inspections, and lowering fuel costs.

TEXACO *Industrial Lubricants*



DIESEL PROGRESS

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COVER ILLUSTRATION
Alfred P. Sloan, Jr.'s 235 ft. Twin Screw Diesel Yacht *René*.

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THIS GUIDE TO ICE PLANT PROFIT

Just published. For ice manufacturers . . . about ice manufacturers . . . exclusively. Reveals the remarkable savings on power cost per ton effected by users of CP Diesel Engines. Deals with typical ice plants only. Names names. Gives plant capacities, equipment, operating costs . . . and savings. Illustrates engine installations and space-saving layouts. Reproduces letters received from owners themselves. Interesting . . . informative . . . comparative . . . definite . . . a valuable guide to greatly reduced power costs and greatly increased profits for YOU. A copy is yours for the asking. Ask!

CHICAGO PNEUMATIC TOOL COMPANY
ENGINE MANUFACTURERS FOR MORE THAN 30 YEARS

6 EAST 44th STREET
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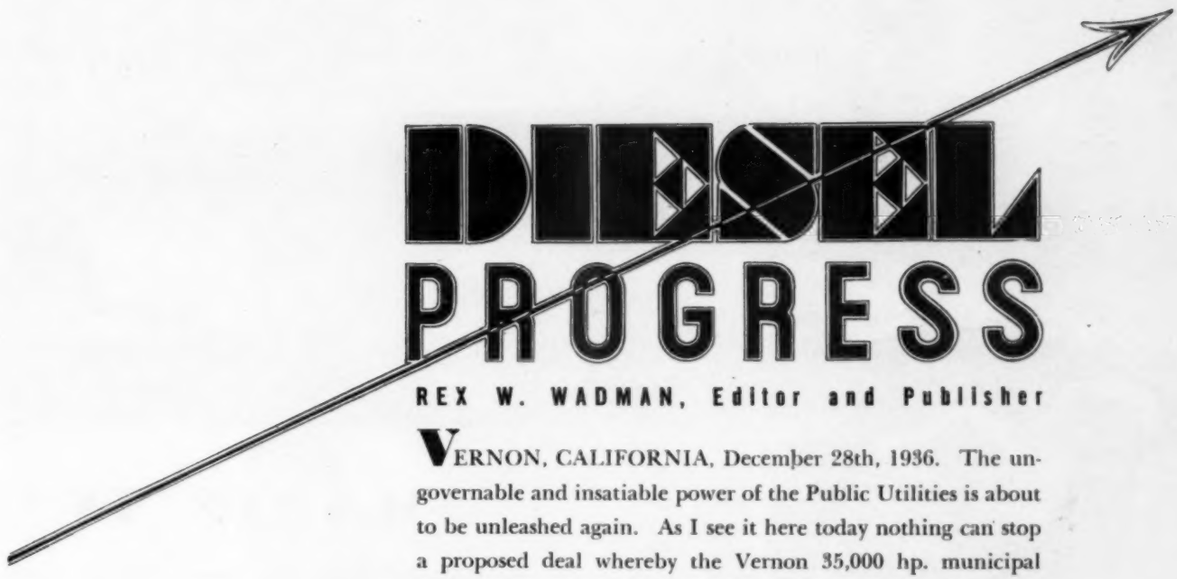
CHICAGO PNEUMATIC DIESELS



DIESEL PROGRESS

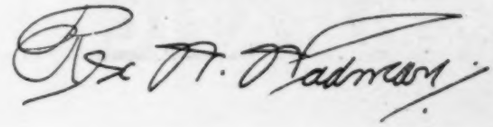
REX W. WADMAN, Editor and Publisher

VERNON, CALIFORNIA, December 28th, 1936. The ungovernable and insatiable power of the Public Utilities is about to be unleashed again. As I see it here today nothing can stop a proposed deal whereby the Vernon 35,000 hp. municipal Diesel power plant will be, very shortly, taken over by a local Public Utility and shut down, probably for all time.

The deal is, as I understand it, for the Public Utility to consummate a lease of this huge power plant for a period of ten years with an option to renew for another ten years. The terms indicated are that the Utility will pay off the outstanding bonds (approximately three and a half millions) and, in addition, pay a franchise tax to the City of Vernon of 2 per cent on gross sales of all power sold within the city. Furthermore, the tentative arrangement apparently calls for a guarantee that rates charged in Vernon will never exceed the rates charged by the Los Angeles municipally owned power plant, and further that rates charged in Vernon will equal the lowest rates granted by the Utility in any other territory it covers.

On the surface a good deal for Vernon. But it isn't, neither is it a good deal for the stockholders and customers of the Utility. This Vernon Municipal Diesel Power Plant has been and is operating at a profit. In course of time this profit would bring recurring rate reductions and, at all times, the City would have the protection of its own plant against the arbitrary rate making capacity of a monopolistic Utility.

Nevertheless, the deal will go through, as I see it, approximately as indicated and another money saving, money making Diesel plant will be closed down by a grasping, over-powering Utility and its stockholders and customers will have to pay the freight, in this instance running into the millions of dollars.



"MARIE IV"

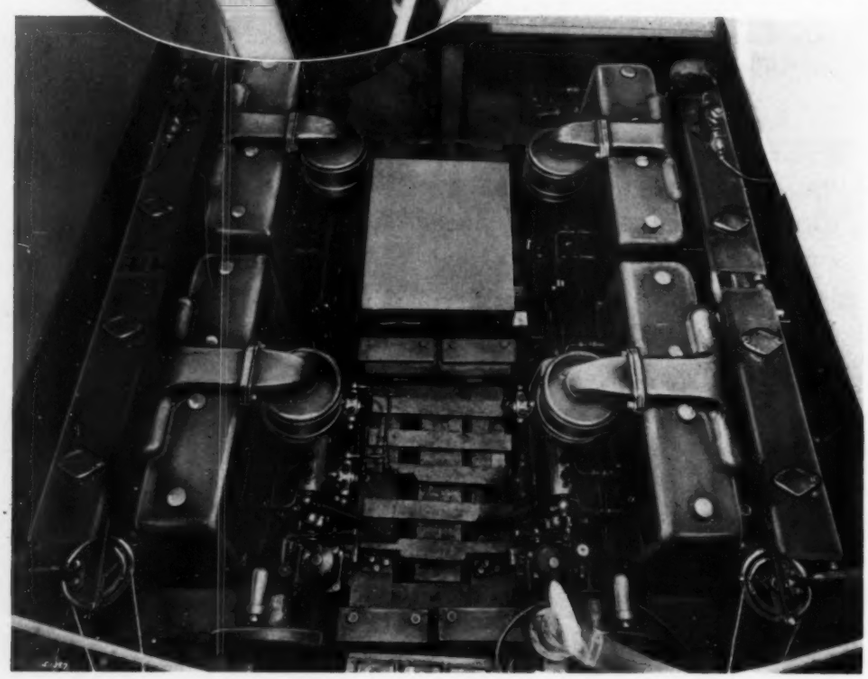
Wheeler Deep Sea Sport Fishing Yacht

The Cummings are a sea-going family and seem to be highly pleased with their new Diesel yacht.

Courtesy N. Y. Daily News

ONE of this season's outstanding Diesel installations for yachting service has recently been delivered by the Wheeler Shipyard to Mr. U. O. Cumming of New York City. This vessel, the *Marie IV*, is one of Wheeler's standard designs developed to provide ample cruising accommodations with the necessary facilities attendant to deep-sea sport fishing. Principal dimensions are: length, 50′ 8″; beam, 13′ 3″, and draft, 3′ 3″. Two 150 hp. Superior Diesels of eight cylinders each and directly connected to 21″ by 13″ wheels give a speed of sixteen miles per hour at 1,750 rpm. From the standpoint of maximum comfort to owner and guests while cruising or trolling it is interesting to note the extensive utilization of Burgess Acousti-Plate. This effective sound deadening material is installed throughout the engine space as well as in the main saloon and is highly effective in eliminating both inboard and outboard sound. The sheathing in the engine room is metal with materials suitable to the interior trim employed elsewhere. An additional advantage to soundproofing the saloon is the insulating effect against sun rays.

The *Marie IV* has complete cruising accommodations, which include owner's stateroom, guest stateroom, alcove settee and bed for one, sleeping accommodations on the bridge for two and complete crew's quarters for two. When it is desired to use the boat purely for cruising all of the fishing gear can be dismantled and left ashore.



300 Superior Diesel horsepower, snugly fitted below decks, yet readily accessible.

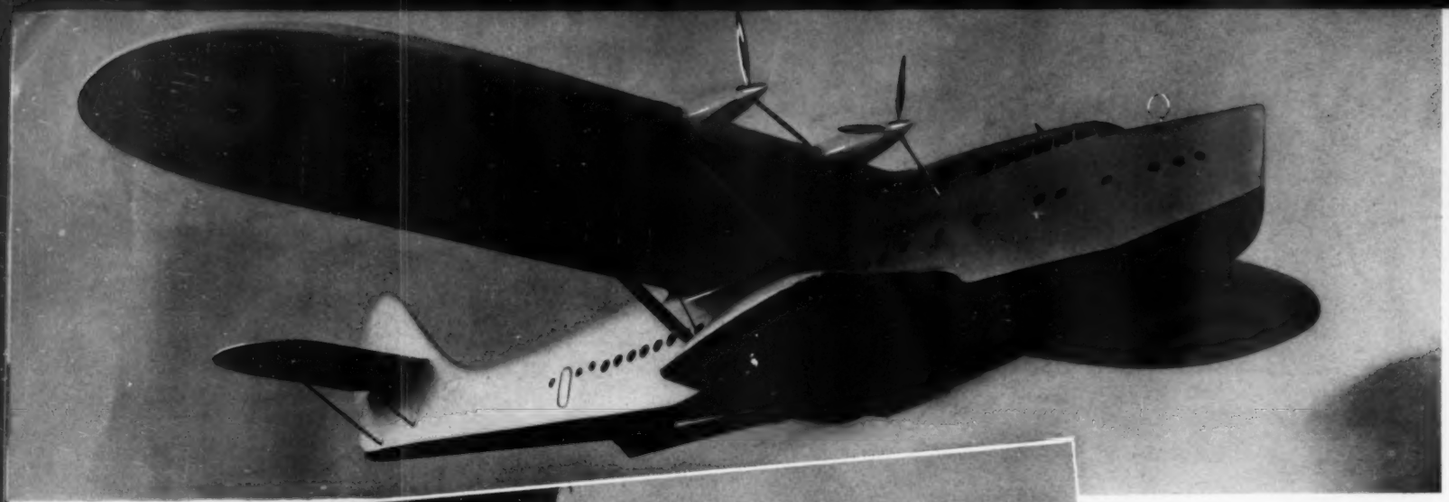
The helmsman has everything at his finger tips on "Marie IV" and plenty of visibility.

For guests tired of fishing these cruising accommodations will be a delight. Sport and comfort both were designed into this attractive vessel.

Both Mr. and Mrs. Cumming are ardent fishermen and have used their boat to take tuna off Montauk Point and Block Island. For marlin and dolphin, they cruise along the Maryland shore near Ocean City. To date they have not tried for swordfish with the new vessel, but have had their share of albicore and bonitas.

The final proof of any boat or engine is the owner's regard for his equipment after seeing it in service. The following statement by Mr. Cumming speaks for itself: "I think a great deal of my Diesel engines and during their first summer's service they were 100 per cent satisfactory. After using gasoline engines in cruisers for a number of years I would not, under any circumstances, revert to them except for high speeds. In addition to the greater cruising radius and elimination of fire hazard, there is no comparison between the cost of gasoline operation and the economy of Diesels. We have never had at any time any difficulty in starting these engines and have never experienced any objectionable odor."

These statements by such a veteran yachtsman as Mr. Cumming, who has owned and used both gasoline and Diesel engines, should dispel any lingering doubts as to the superiority of the Diesel for yacht propulsion. There are countless other yachtsmen who share Mr. Cumming's enthusiasm for safe, economical cruising.



Eight-engined Dornier Do 20 flying boat designed for Deutsche Lufthansa's transatlantic service. Each propeller is driven by two engines in tandem in the wings. Its wing span is 160 ft. and its weight is 64 tons.

Three-engined Junkers Ju 52 airliner, of a type largely used in Europe. This plane is equipped with Junkers Jumo 205-C engines and has accommodations for 15 passengers.

DIESEL ENGINED AIRCRAFT IN 1937

By PAUL H. WILKINSON

THE year 1937 undoubtedly will be a banner year for the Diesel in aviation. During the next twelve months, the Zeppelin *LZ-130* will be placed in transoceanic service, equipped with four of the 1,100 hp. Mercedes-Benz *LOF-6* engines which have given such excellent results on the *Hindenburg*.

In the airplane field, the huge Dornier *Do 20* flying boat with its eight powerful Diesel engines is expected to be completed for passenger service across the Atlantic. Seaplanes built by Blohm & Voss and powered with four Junkers *Jumo 205* engines, will be used by Deutsche Lufthansa to carry the mails from Europe via Lisbon and the Azores to New York.

In 1936 a great deal of publicity was given to the flights of the *China Clipper* across the Pacific. Little was said, however, about the excessive load of expensive gasoline which had to be carried and which made profitable operation impossible. If Diesel engines of equal

Proposed four-engined flying boat. Accommodations for the passengers are provided in the twin hulls. The control cabin is in the center portion of the wing.

Passageway inside the wing of a Junkers G-38 airliner. On the right are the instruments for the four engines which are under the supervision of the Flight Engineer. This is an example of the new type of airliner where the Engineer's duties are confined within the wing.

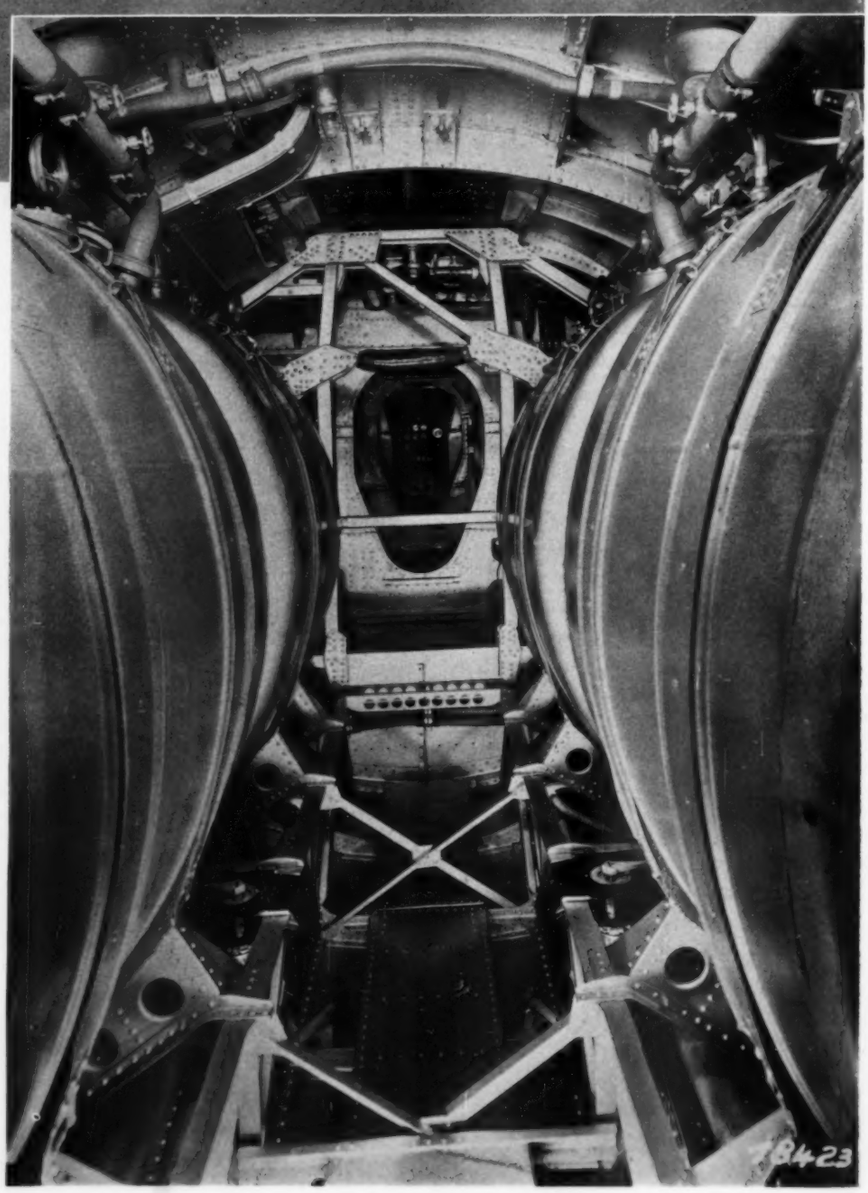
power had been used, the weight of fuel carried could have been reduced by nearly 30 per cent. This would have made possible an increase of 100 per cent in payload and a reduction of 75 per cent in operating cost, enabling it to operate at a profit instead of at a loss.

While the United States has been wasting time and money trying to squeeze a few more horsepower from the obsolescent gasoline aircraft engine, Germany has been forging ahead with the development and production of high-powered Diesel engines. The Junkers *Jumo 205*, which powered the Dornier *Do 18* flying boats when they surveyed the North Atlantic air routes last year, now has a power output of 700 hp., which is equivalent to 1.6 lbs. per hp. Turbo-supercharging has also been successfully applied and the performance of this engine at high altitudes is said to be remarkable.

Within the next few months a more powerful Junkers engine will be introduced. The eight-cylinder *Jumo 206*, in the 1,000 to 1,500 hp. class, will be an excellent power plant for the new European transoceanic flying boats and

The largest Diesel-engined plane in the world. View of the Junkers G-38, powered with four Junkers Jumo 204 engines of 750 hp. Accommodations are provided for 34 passengers. It has a wing span of 144 ft. and weighs 27 tons.

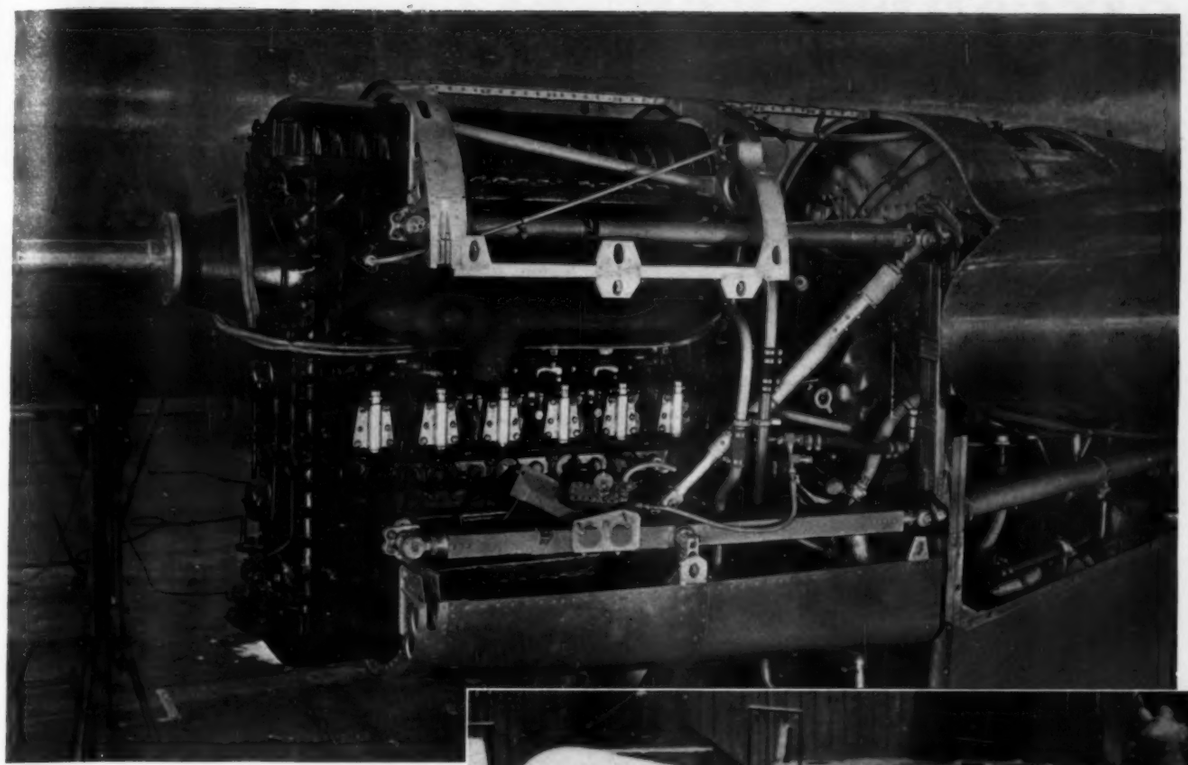
Junkers Ju 86 high-speed transport taking off from the airport. Two Junkers Jumo 205-C engines of 600 hp. provide the motive power. The landing gear has not yet been retracted.



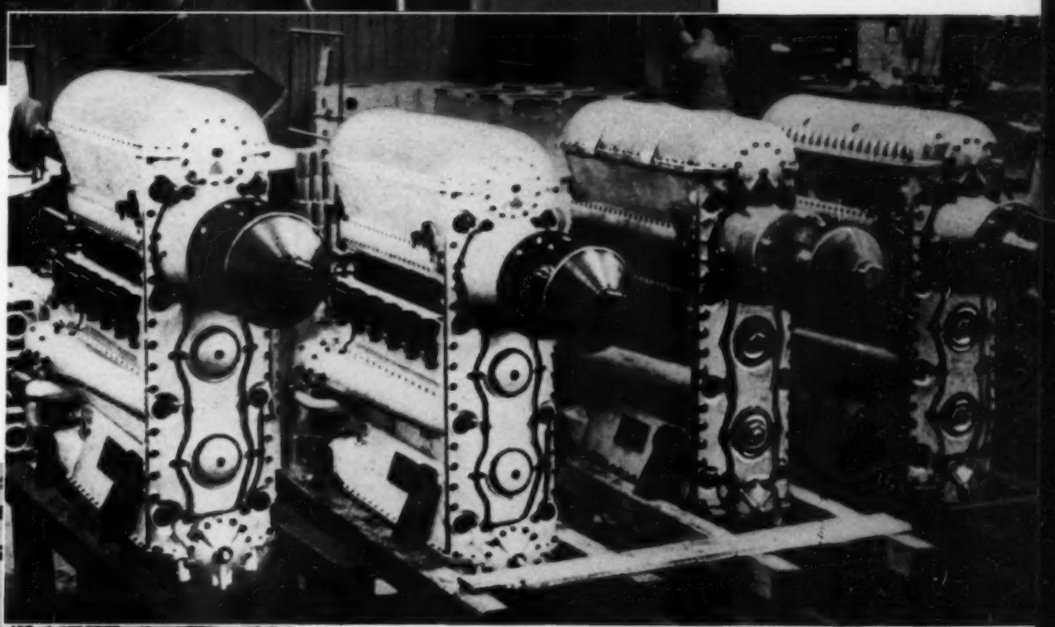
long range land-planes. These Diesel-engined planes will place American gasoline-engined planes at a decided disadvantage with regard to both payload and operating cost.

It is understod that work is proceeding on an extremely compact Junkers engine of 1,500 to 2,000 hp., which will far surpass anything the United States can hope to attain with the gasoline engine. From then on, it will be only a short step to Diesel engines of 5,000 to 10,000 hp. for the super-planes of the future.

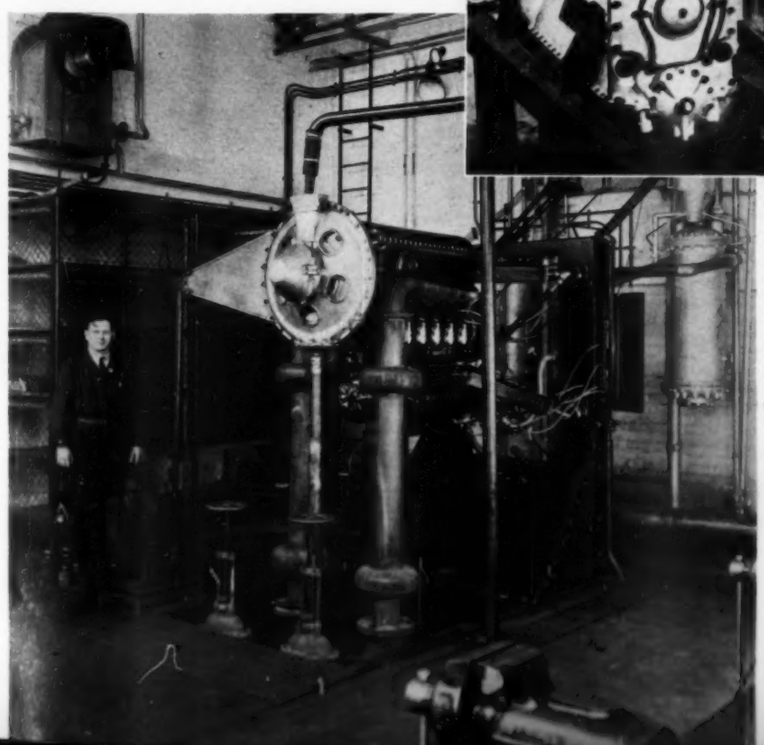
All-in-all, the prospects for the Diesel engine in aviation for 1937 are most promising. More powerful engines will be in production, and fuel consumption probably will be reduced. Turbo-supercharging will add to the Diesel's performance at high altitudes and enhance its use for military purposes. Last, but not least, freedom from fire hazard will continue to be the Diesel's monopoly – for, try as they may, the sponsors of the gasoline engine can never eliminate this menace from their planes!



Left: Fuel tanks in the hull of the Dornier Do 18 flying boat. Four 165-gallon tanks supply the two Junkers Jumo 205-C engines. Looking forward through the bulkheads, one sees a portion of the instrument panel in the pilot's cabin.



Installing a Junkers Jumo 205-C engine in the wing of a Junkers Ju 86 transport plane. The four-point engine suspension is worthy of note. Behind and below the engine is the air scoop for the radiator.



View in the test house, showing how the Junkers Jumo 205-C engine is mounted on the stand and connected to a Junkers water brake while it undergoes its fifty-hour test run. Large pipes lead the exhaust gases to the outside of the building.

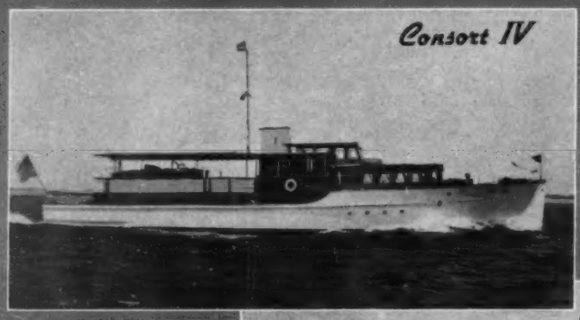
The finished product. Junkers Jumo 205-C engines at the factory ready for shipment.

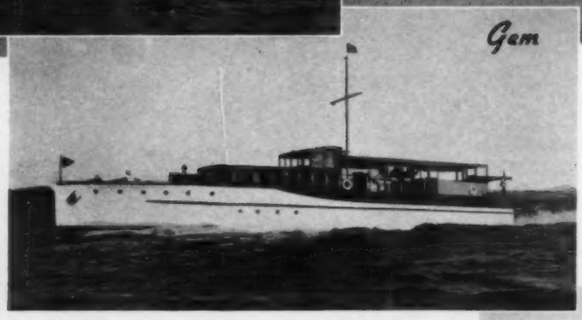
Presenting **THE GREATEST SINGL**

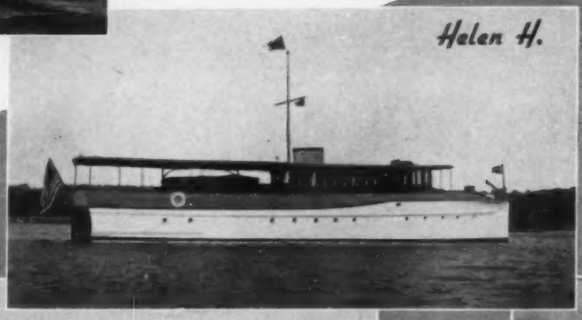
EVER EFFECTED IN THE DEVE

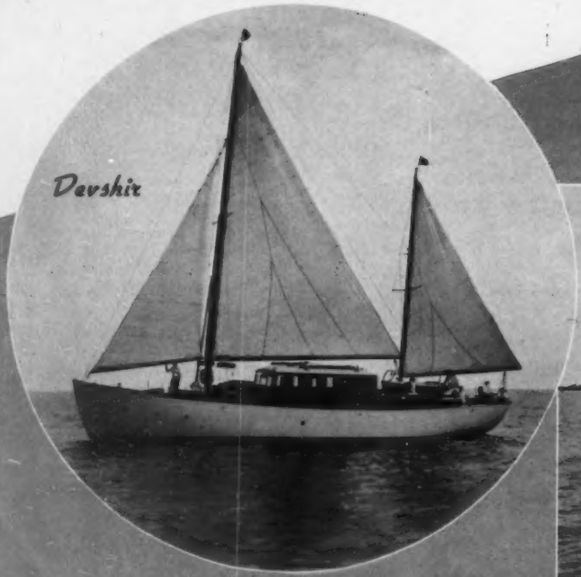
MODERN DIESEL MARIN

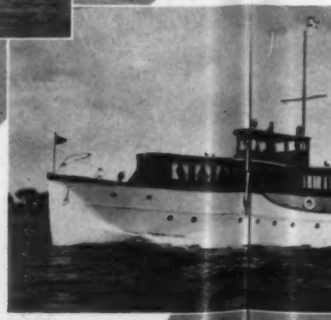
WINTON UNIT FUEL INJECTI











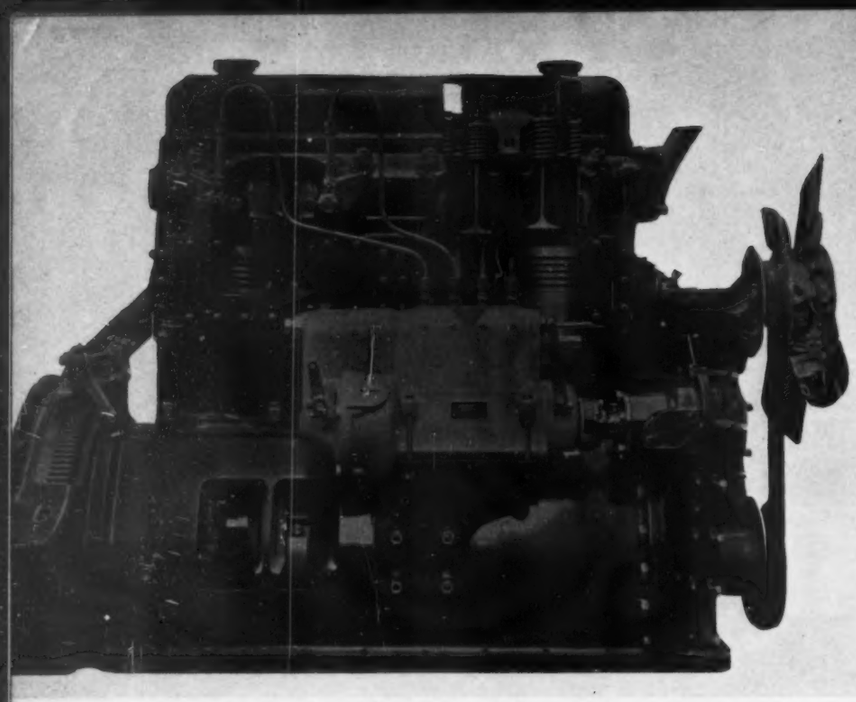
NGLE ADVANCE
DEVELOPMENT OF
RINE ENGINES

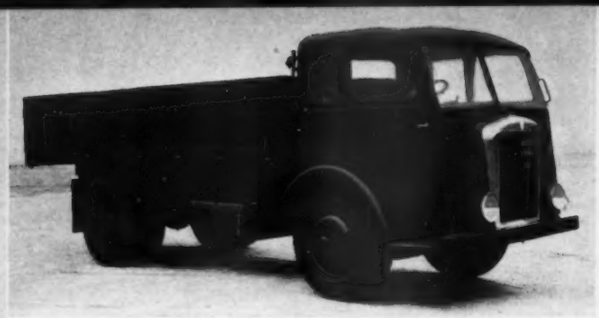
ECTION SYSTEM

Symbol of Economy and Dependability

THE latest Winton-Diesel marine engines, lightweight, high-speed rugged units, embody the unit fuel injection system. This brilliant engineering achievement, by permitting the successful application of Winton-Diesel engines to high-speed streamlined trains, effected revolutionary changes in rail transportation. Now this epoch-making fuel injection system is presented in engines designed especially for pleasure craft and is repeating its railroad triumphs in the marine field. The illustrations show a number of the outstanding yachts utilizing this new Diesel refinement.

WINTON ENGINE CORPORATION
CLEVELAND, OHIO, U. S. A.





Six cylinder Berliet lorry with 8.6 litre Diesel. Left: 4.4 litre, 63 bhp. four cylinder Ricardo Diesel.

LONDON LETTER No. 14

By GEORGE LIND

SINCE last writing about road transport matters in these columns another Paris Salon has come and gone. As usual, in the heavy vehicle section the Diesel was well to the fore, no less than 22 different makers using this type of power unit.

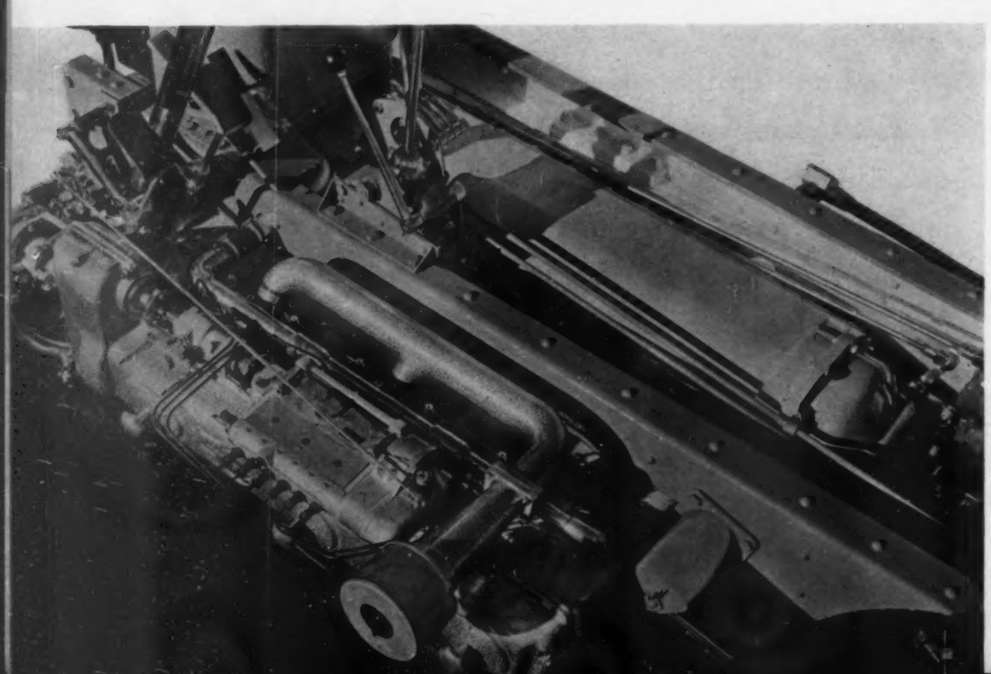
Among other exhibitors of particular note was the Compagnie Lilloise de Moteurs, who build lorry engines of the Junkers opposed-piston type under license. The engines shown were much the same as in previous years except that in some examples a mild amount of supercharging has been obtained by a fan driven from the crankshaft.

The latest Berliet has what is known as multiple turbulence, or in other words, a modified Ricardo Comet combustion system. Four different sizes of unit are made, ranging in cubic capacity from a 4 cylinder of 4.4 litres to a six of 8.6 litres. The 4.4 litre engine, an illustration of which is shown, develops some 63 bhp. at 2,200 rpm. and has a fuel consumption of 4 lbs. per bhp. hour. It is a neat, workmanlike job and should give good service on the road.

Panhard and Levassor, those pioneers of internal combustion-engined road transport, exhibited their well known sleeve-valve Diesel as well as a new direct-injection unit. The sleeve-valve engine, built in four and six cylindered sizes, developing 70 and 100 bhp. at 1,800 rpm. in each case, is one of the cleanest looking power units at present on the market. Bosch fuel pumps and injectors are used, the jets being directed vertically into the combustion chambers.

There were, as usual, no British exhibits, but the Gardner Diesel, manufactured under license by such concerns as Panhard and Delahaye, is rapidly increasing in popularity, following its highly successful performance in operation since making its first appearance in France little more than a year ago. Actually the balance between pre-combustion and direct injection engines was about level at the Paris show, a point worth noting in view of what will be said later in this article on British developments.

One of the most interesting machines seen in Paris, though not actually at the show, was one of the latest Bussing-N.A.G. Trambusses. These single deck machines are designed to take 53 passengers and luggage, and are powered by a six cylinder 13.74 litre Diesel, developing 140 bhp. They are six-wheelers, driving to both rear axles, and have the engine slung horizontally beneath the front of the chassis frame. In order to obtain as much accelerability as possible all the auxiliaries are mounted on the cylinder head casting, the camshaft being of overhead type as well. The whole design is both ingenious and robust and



Front end arrangement of Bussing-N.A.G. trambus chassis. Note clever grouping of auxiliaries. Right: New 83 bhp. four cylinder North Eastern Nemesis Engine.

displays throughout that Teutonic thoroughness and attention to detail which is so often imitated, but so rarely equalled outside the Reich.

Returning now to this country, the two most remarkable transport developments of the last six months have been the swing over to direct injection and the introduction of two new engines, the North Eastern and the Meadows, in addition to the radical modification of a number of existing units. Just why the British manufacturers should suddenly decide to forsake perfectly sound pre-combustion chamber designs for direct injection is hard to understand. That direct injection has many advantages is well known, nevertheless, as a principle only in a few cases is it found superior to the rival pre-combustion chamber systems. Possibly the lure of greater simplicity in manufacture and the avoidance of heater plugs for starting in the case of direct-injection engines has induced the firms in question to make a change. At any rate, the performance of the new units is little better than when using the pre-combustion chamber designs.

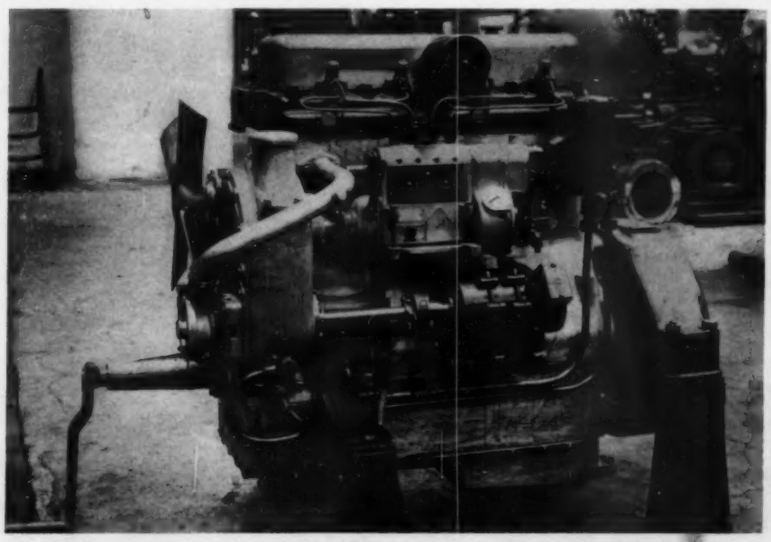
Dealing now with the new Meadows engine, this is a four cylinder unit with a total swept volume of 5.195 litres and a power output of 74 bhp. at 2,000 rpm. It is a high-grade product, and, as will be seen from the above figures, has a performance quite equal to similar machines of other makes. The engine is built largely of Elektron, whilst the combustion chambers are designed to incorporate the Lanova system.

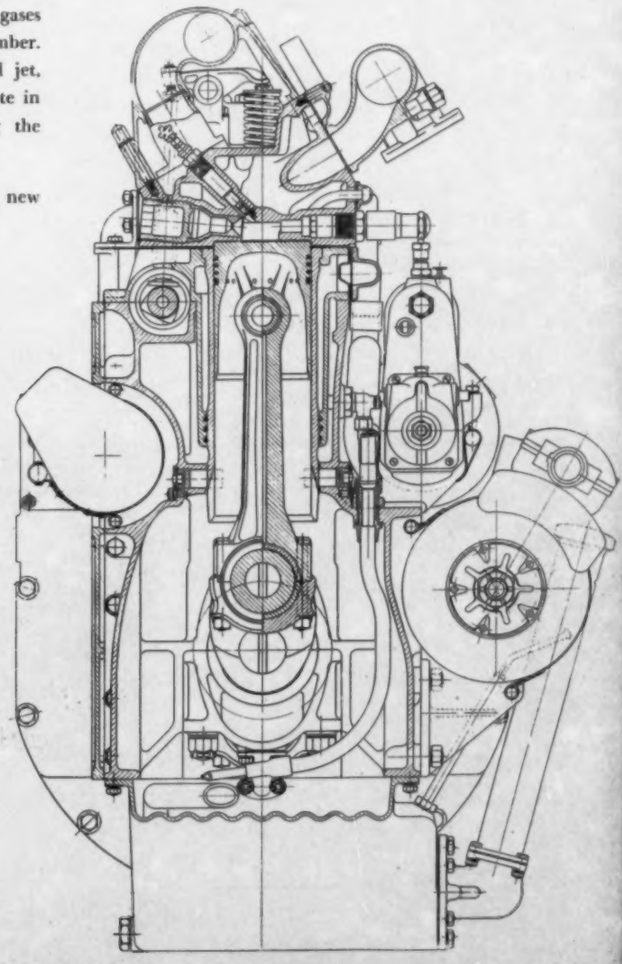
An extremely deep Elektron casting forms the cylinder-crankcase unit. This actually extends from immediately below the tops of the wet nitrided cast iron cylinder liners to a point well below the crankshaft center line. A deep sump is bolted to the lower face. It is noteworthy that the main-bearing studs are continued through the case, their upper extensions being used to secure the cylinder block proper.

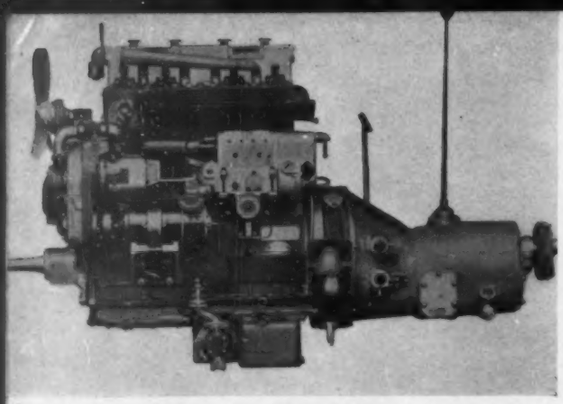
The cylinder heads are cast in pairs in chromium iron, detachable valve guides being employed to support the vertical push-rod-operated valves. The clearance volume above the piston at top dead center consists of two chambers, i.e., the main combustion chamber which is approximately in the form of a figure 8, the valves being located in the lobes of the 8, and an auxiliary air chamber or energy cell. The fuel injection nozzle and energy cell lie on an axis at right angles to the main cylinder centers. The air cell is placed on the opposite side of the main combustion chamber from the fuel nozzle, roughly at the intersection of the lobes. The fuel spray on its way from the nozzle passes across the main combustion chamber and a pre-determined amount of fuel enters the energy cell and is there intimately mixed with the air. Combustion commences at the funnel shaped mouth of the cell and the fuel in the air cell is ignited. In consequence there is a rapid rise in pressure in the air cell, greatly exceeding the pressure in the main chamber, resulting in the expulsion of the gases from the energy cell into the main chamber. These gases, driving out towards the fuel jet, cause the air in the main chamber to rotate in a double swirl, thus intimately mixing the unburnt fuel and air.

In contrast to the Meadows engine the new

7 ton Thornycroft "Trusty" lorry with 85 bhp. Diesel. The engine above is a Meadows-Lanova Diesel, a cross-section of which is shown directly below.







Latest four cylinder Thornycroft Diesel which develops 85 bhp. at 2,200 rpm. This engine is installed in the Foster-Clark lorry shown on the preceding page.

North Eastern Nemesis power unit is of the direct-injection type. As will be seen from the accompanying illustrations, the engine has four cylinders cast *en bloc*. The four stroke cycle is used in conjunction with overhead push-rod operated valves and the injection and combustion arrangements are of a special type developed for the Nemesis engine. The combustion chamber consists of a simple open chamber in the head of the piston into which the fuel is injected at an angle of 19° to the vertical through a nozzle having .014 in. diameter holes, the spring-loaded nozzle valve being set to open at about 3,000 lbs. per square inch. The inlet and exhaust valves, ports and passages are of special disposition and design, the arrangement ensuring that a rotary motion is imparted to the air. It is claimed that the speed of rotation of the air charge about a vertical axis is four and a half times the crankshaft speed and that, as a result, very even combustion and good starting are obtained. A 14.5 to 1 compression ratio is used.

The cylinders have a bore and stroke of 108 mm. by 160 mm., the swept volume being 5.85 litres. Complete with flywheel the unit weighs 1,100 lbs. dry, and with an output of nearly 85 bhp. this gives a power weight ratio of 12.9 lbs. per bhp. To obtain this creditably low figure much use is made of light alloys. The cylinder block and upper half of the crankcase, for instance, are in one casting of special aluminium alloy. The sump is also of aluminium and the cast iron cylinder liners are pressed into the block and in direct contact with the cooling water. In passing, it should be mentioned that, owing to the combustion system employed, hand starting from cold is quite feasible, though a starter motor is, of course, a standard fitment.

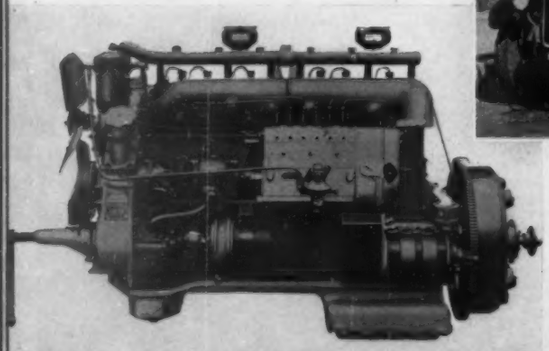
As regards performance, the Nemesis engine compares very favorably with its contemporaries. At 2,000 rpm. it develops 83.5 bhp. at a b.m.e.p. of 93.5 lbs. per sq. in. The lowest recorded fuel consumption, .368 lbs. per bhp. hour, is obtained at 1,000 rpm. and the highest b.m.e.p. (116 lbs. per sq. in.) with a shaded exhaust, at about the same speed.

With regard to recent radical modifications in existing engines the following makes are dealt with briefly here – Thornycroft, Albion, Dennis and Dorman.

Thornycroft

The latest Thornycroft Diesels are the result of the improvements developed after a long period of research and experiment embodying cylinder heads with Ricardo type combustion chambers. Both engines are of similar light compact, but robust construction and have a bore and stroke of 4⅛ in. and 6 in.; the four cylinder model is conservatively rated at 85 bhp. at 2,200 rpm. as is the six cylinder unit at 125 bhp. also at 2,200 rpm., the b.m.p. attained at 1,400 rpm. being 105 lbs. per sq. in. The smaller engine has a capacity of 5.225 litres and the larger engine 7.88 litres. The combustion system employs separate rotary swirl chambers with pintle type atomizers with an injection pressure of 1,470 lbs. per sq. in. The compression ratio is 16.3 to 1. Besides technical improvements these engines have been cleaned up considerably and are now neat, businesslike jobs.

9 Ton six-wheeler and its 90 bhp. six cylinder Albion Ricardo Diesel.



Albion

Based, in respect of its general design, on the well known Albion high-camshaft unit, the new modified Diesel is of the pre-combustion chamber type. It is built as a 6 litre or 7.347 litre six cylinder engine and develops either 80 or 90 bhp. at 2,000 rpm. The cylinder block and upper half of the crankcase are cast in one piece of cast iron, dry renewable liners being fitted. The valves are carried in two detachable cylinder heads, and are operated through bell crank rockers, the camshaft being located in the upper portion of the cylinder block. All the auxiliaries are confined to the near-side, leaving the off-side absolutely clean. Albions have spent much time and money in perfecting this new engine and great things are expected of it in service.

Dennis and Dorman

These two firms are the leaders in the latest "back to direct injection" movement. Both have in the past built highly successful pre-combustion chamber engines and both almost simultaneously have brought out new ranges of direct injection power units.

Again the outcome of a long period of experiment and test, the latest Dennis engine has now been thoroughly proved, having been subjected to a long trial in the hands of a prominent public service vehicle operator and under particularly exacting conditions. Externally the new model closely resembles the now obsolete Dennis-Lanova unit, though the cylinder head is different. It has four cylinders, giving a total swept volume of 6.5 litres and develops 80 bhp. at the governed speed of 1,750 rpm., the compression ratio being 13.8 to 1. Four valves are used per cylinder and the fuel is sprayed from a vertical injector along the piston top at a small angle to the horizontal. Whilst undoubtedly a sound machine, it is hard to see why Dennis' gave up their old design, which in point of power per litre and general smoothness was definitely superior to the new engine.

The case of Dorman's of Stafford is somewhat different, the direct injection units being an addition to, rather than a substitution for, their present range. The engines are straightforward units of varying powers, the 12.2 litre six cylinder model developing 128 bhp. at 1,500 rpm. Although built on more robust lines, with a view to the industrial markets, it is interesting to compare the power output of the direct injection engine to the Dorman-Ricardo range – 10.2 bhp. per litre for the one and 17.8 bhp. per litre for the other.

THE U. S. ENGINEERS' DREDGE "JEWETT"

CONGRATULATIONS to the U. S. Engineers on the successful performance of the self-propelled pipeline dredge, *Jewett*, on her recent trial trip held December 4th.

Particularly is credit due Major Elliot Van Devanter who is in charge of the Marine Design Division of the U. S. Engineers, and Mr. Hugo H. Haas, Engineer in charge of Diesel work for the U. S. Engineers.

The dredge takes its name from Colonel Henry Clay Jewett of the Corps of Engineers, who was born on April 8th, 1879, and died on October 18th, 1934.

The dredge *Jewett*, constructed by the Dravo Contracting Company at their Neville Island Shipyard, Pittsburgh, Pa., is the largest cutter head hydraulic dredge ever to be built for inland rivers. Its principal dimensions are:

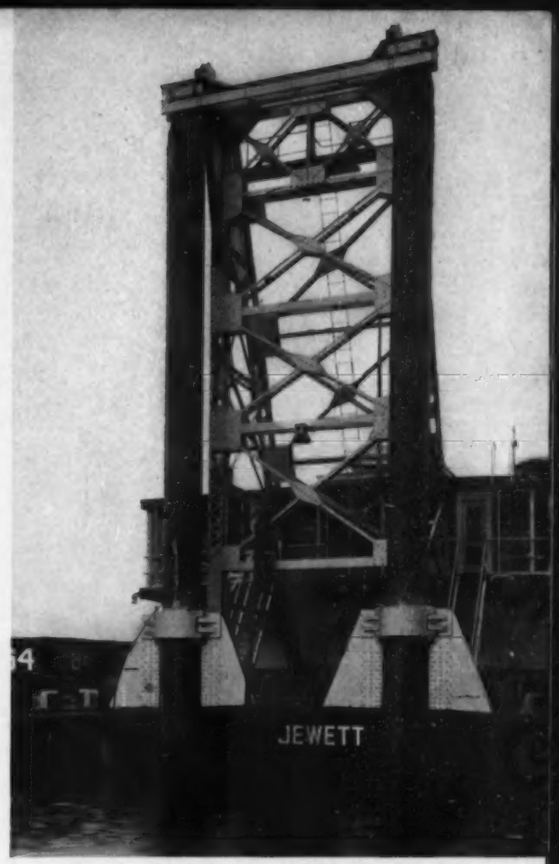
Length of hull, 230 ft.; length overall, 272 ft.; beam, 48 ft.; draft, 5 ft. 6 in.

The *Jewett* is a self-propelled dredge capable of making a speed of approximately 10 miles per hour when travelling to and from dredging projects. Its twin propellers operating in tunnel form in the stern of the hull are driven by two Busch-Sulzer direct connected, 2-cycle Diesel engines, rated at 750 hp. The 20 in. diameter dredging pump is driven by a 1,600 hp., 6 cylinder, Busch-Sulzer Diesel engine direct connected to the pump. This big engine is connected to the dredging pump through the medium of a Farrel-Birmingham Gearflex coupling.

It is obvious in a vessel of this size that the electrical requirements are somewhat large, and these requirements are taken care of by an 840 hp. Busch-Sulzer Diesel engine direct connected to an Elliott generator operating at 250 rpm. In addition to this main generating set there is a 75-kw. Winton Diesel generator for stand-by service and a 15-kw. Winton Diesel generator set for lighting purposes when the dredge is not in operation.

The equipment installed in connection with the various Diesel engines on this particular vessel is very complete as is the case with all designs emanating from the U. S. Engineers.

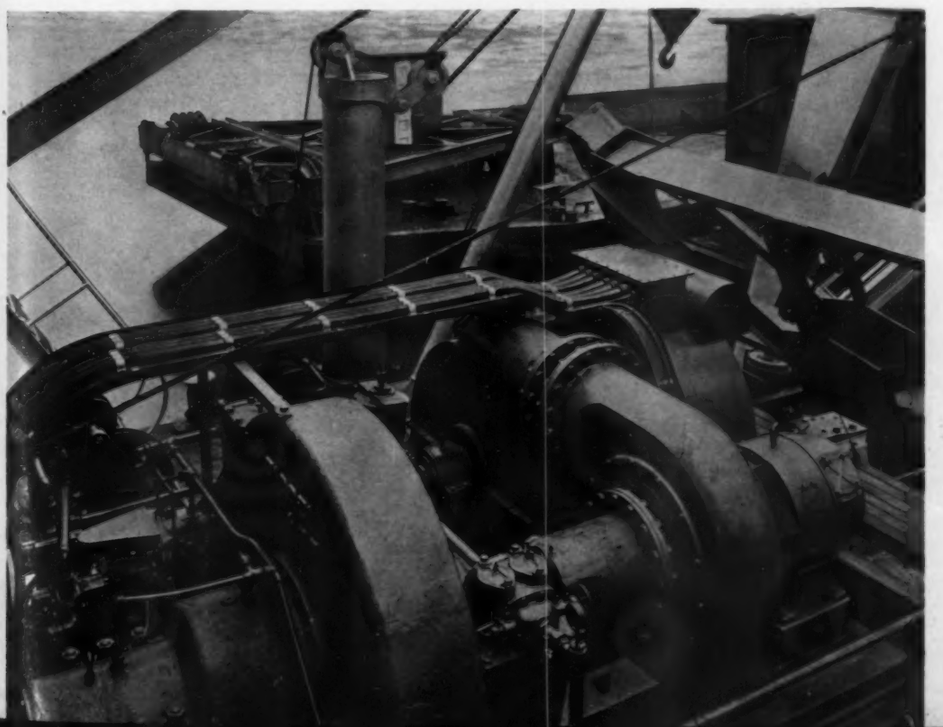
Amongst the oustanding units might be mentioned three type sixteen Sharples en bloc centrifuges, one to handle the fuel and two to handle the lubricating oil. All exhaust problems are handled by Vortex Spark Arrester Silencers. Two Weston Tachometers are used on the control board of the two propelling engines and three additional Weston Tachometers are mounted on the bridge. Nugent filters are used on all of the Busch-Sulzer engines and Purolator filters on the two Winton engines.



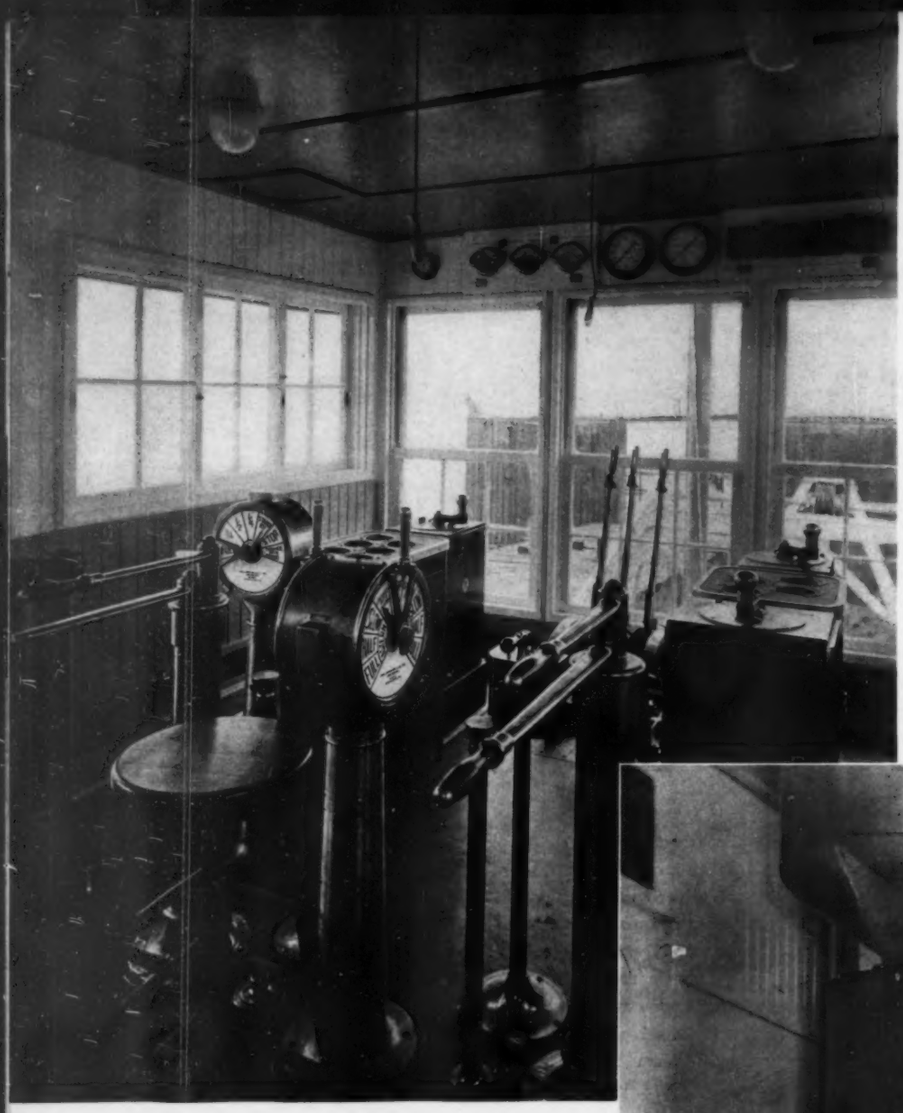
Stern view of the "Jewett" showing the two massive spuds.

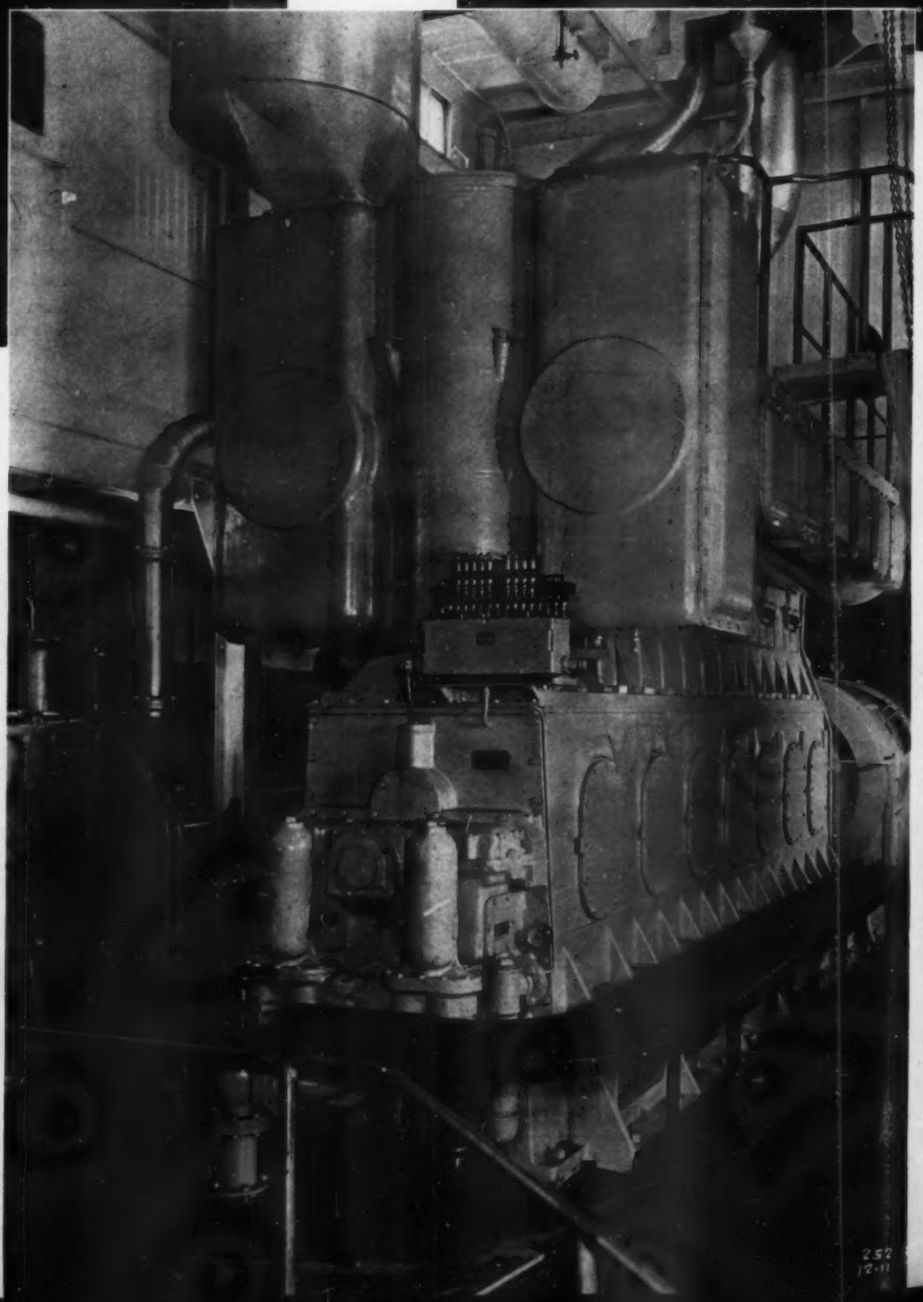
Farrel-Birmingham equipment is found throughout this outstanding new vessel. For instance, the 450-hp. motor drives the cutter head shaft through a Farrel-Birmingham reduction gear and the 125-hp. winch motor drives a winch through a Farrel-Birmingham speed reducer.

In order to make available the heat from the exhaust, an exhaust gas boiler of the Clarkson type has been installed in connection with the main dredging engine. This boiler was manufactured by the Electric Boat Company and has a capacity of 815 lb. of steam per hour at 25 lb. pressure when the dredge pump engine is operating at rated load. It is arranged for burning fuel oil when the engine is not ope-



Ladder driving unit showing Farrel-Birmingham speed reducer.





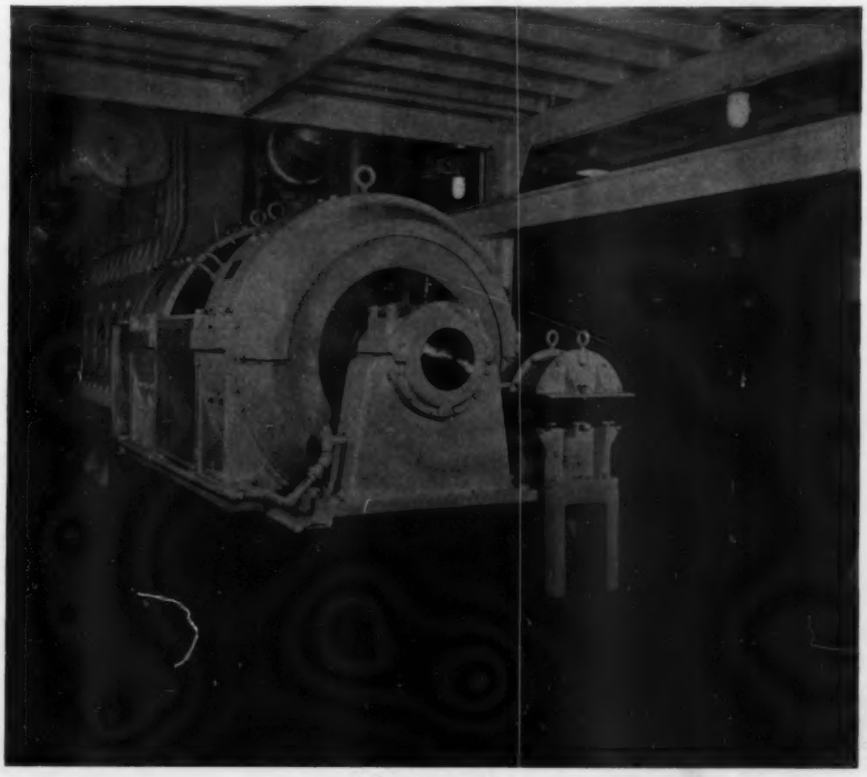
Bridge showing three Weston Tachometers in top, left. Henschell engine room telegraphs, etc. Right: Main generating engine.

rating and the oil firing system is completely independent of the exhaust heating system.

A very comprehensive system of carbon-dioxide fire protection is provided for the propelling engine space, pump, engine pit, paint, lamp and oil room. The system is so arranged as to extinguish large fires by the total flooding method and each compartment so provided can be entirely flooded. In addition, there are provided seven hose reel-type, carbon-dioxide fire extinguishers located along the main deck. Local protection for the living spaces is provided by means of hand fire extinguishers.

Because the waters in which the *Jewett* will operate frequently contain a heavy silt content, the engine cooling system developed for this vessel is of particular interest. Current practice in good Diesel engineering circles is to use clean fresh water for cooling purposes and

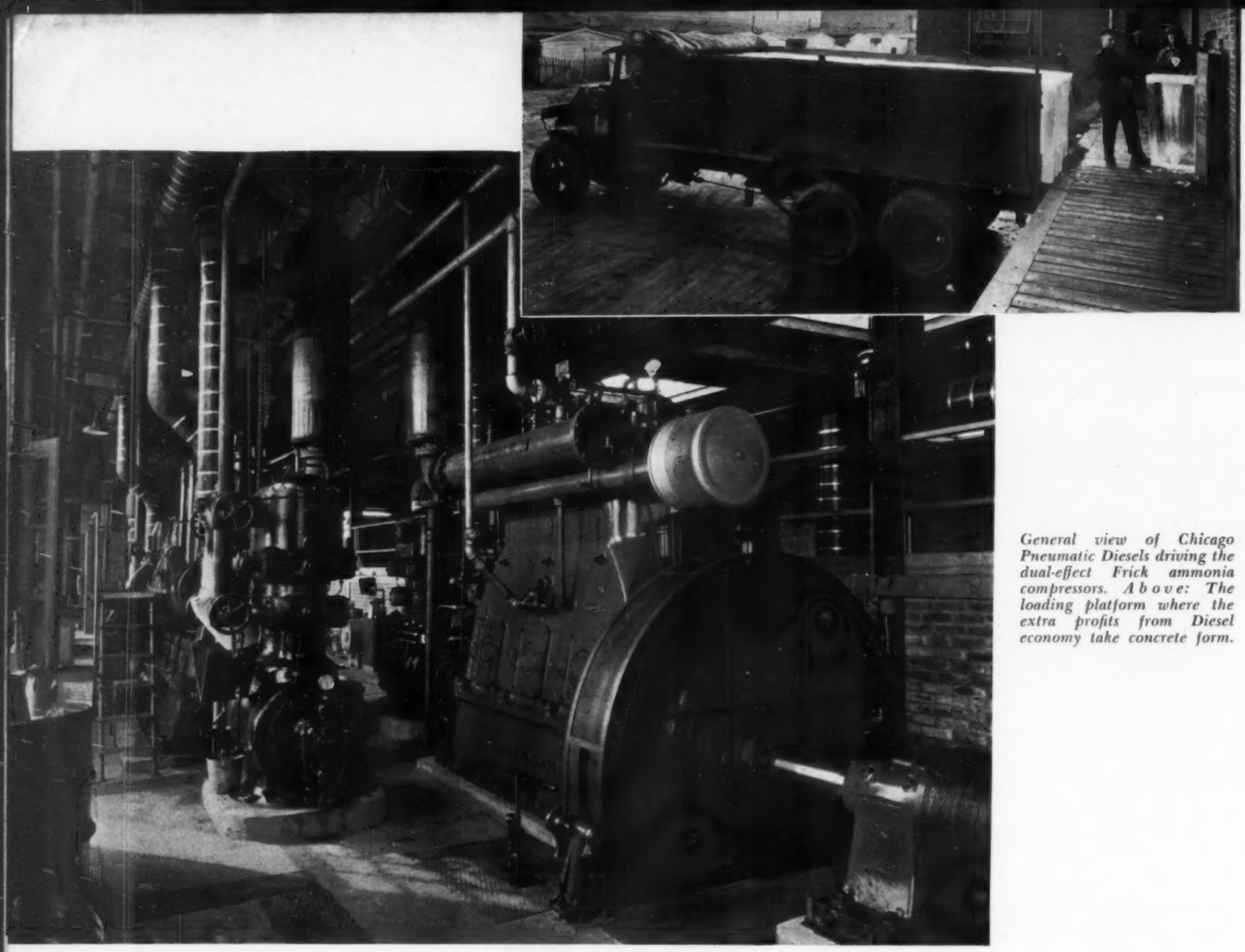
this principle has been applied to the *Jewett*. All the Diesel engines on board are cooled through the medium of closed water systems in which distilled water is used in the jackets and then passed to coolers through which river water is circulated. This closed system method is vitally necessary on dredges when even the normal muddy condition of the surrounding water is aggravated by the disturbance resulting from dredging operations.



The 840 hp. Busch-Sulzer generating engine connected to Elliott generator. Sharples No. 16 en bloc centrifuge in right hand corner, one of three aboard.

With such a large volume of machinery aboard it is necessary, of course, to have a floating machine shop and this is located just aft of the propelling engine room and is very completely equipped, having all the necessary machino tools required for ordinary maintenance work. Just aft of the machine shop is a large winch for the operation of the two spuds which are illustrated at the top of the first page of this article. The winch is operated by a separate 100-hp. motor and has separate drums for each spud which are controlled by pneumatic brakes and clutches quite similar to those used in connection with the ladder hoisting winch.

In conclusion it might be said that the *Jewett* as she goes into service is a worthy addition to the large fleet of U. S. Engineers' vessels. Undoubtedly she is the most modern and completely equipped dredge of her type today, embodying as she does a floating power plant that can be moved from place to place under her own power. The problems met and solved were multitudinous and again we say "Hats off to the U. S. Engineers."



General view of Chicago Pneumatic Diesels driving the dual-effect Frick ammonia compressors. Above: The loading platform where the extra profits from Diesel economy take concrete form.

CENTRAL ICE COMPANY

By JOHN W. ANDERSON

IT may seem a bit unusual to build a new ice making plant today, but that it can be done and done successfully is shown by the Central Ice plant in Brooklyn, N. Y. The secret is first of course in the demand for ice, and second in an economy of operation which will permit the manufacturer to sell the product at a competitive price and at a profit to himself. That is where the Diesel engine enters the picture. Incidentally this plant has the distinction of being the only Diesel driven ice making plant within New York City.

Designed for a total rated ice making capacity of 280 tons per day, there were to be four Frick 10″ x 10″ dual effect two cylinder compressors and three Frick simple effect 10″ x 10″ two cylinder compressors. Only the first four were installed originally. All were motor driven, two of them by a motor between them, while the other two had individual motors. The plant was placed in operation on September 30, 1935, and there was a good sale of ice from the beginning. The power demand overran the peak load figures set in the electrical power contract, and the bills for this power quickly convinced the owners that some other source of power would be needed to make the venture truly successful.

An investigation showed that the Diesel was the answer and the layout was changed accordingly. Two Chicago Pneumatic Diesel engines were installed to drive a dual effect compressor from each end of the engine. The other three simple compressors are driven by individual electric motors of 125 hp. The power for these motors as well as for the auxiliaries and lights is obtained from outside. This is done because the power contract has several years to run, and because the three motor driven compressors are used only in the summer time. Eventually there will be a Diesel engine driven generator for the auxiliaries and lights, and perhaps the three compressors will be converted to Diesel drive.

As shown in the layout of the plant, the ma-

chinery is located alongside of the ice making tanks, with the ice storage at the end, and the loading platform and the office alongside of the storage and in line with the machinery space. This machinery space is open to the tank space, so that the engineer on watch has an easy supervision of the entire ice making process. The entire plant is housed in a plain brick building of rectangular shape and one story in height. The whole provides a simple, convenient, and economical layout.

The ice making tank is composed of the 300 lb. size cans, 68 cans wide and 43 cans long. A half row of 34 cans or 5.1 tons of ice is pulled at one time. Filtered city water is used for ice making. Ammonia is used as the refrigerant for chilling the brine, and the usual head pressure is about 165 lbs. Four Frick shell and tube condensers are used, and the ammonia is cooled by water obtained from a well some 130 feet deep right on the property. This water is returned to the ground through a diffusing well 147 feet deep at the other end of the property. In the summer time there is a flow of 800 gallons per minute, but this is reduced to about 500 gallons in the winter. The water temperature to the condensers is 68 degrees and it comes off at 82 degrees. High pressure air agitation is employed, and the ice produced is clear and of high quality.

Each engine compressor unit consists of a three cylinder, four cycle Chicago Pneumatic Diesel rated at 285 hp. at 300 rpm., and direct connected to the two 10 by 10 Frick dual effect ammonia compressors through Thomas flexible couplings. In case something goes wrong with one of these compressors, it takes about five minutes to shut down the unit, take out four bolts in the coupling, and start up again with that particular compressor disconnected. In normal operation the practice is to run these units at full speed.

The dual effect ammonia compressors have two sets of suction ports, and the refrigerating load is divided between two temperature levels. Hot compressed gas discharged from the compressors flows through the oil separators to the condensers, and the liquid ammonia drains to the receiver. From there it flows up and through an expansion valve into the liquid cooler and into the can water cooler on the building roof. There is just enough expansion of liquid into gas to give the desired cooling effect, and the gas from these two coolers flows back to the compressors to enter them through the upper or medium pressure ports. The remaining portion of the ammonia flows to the brine coolers

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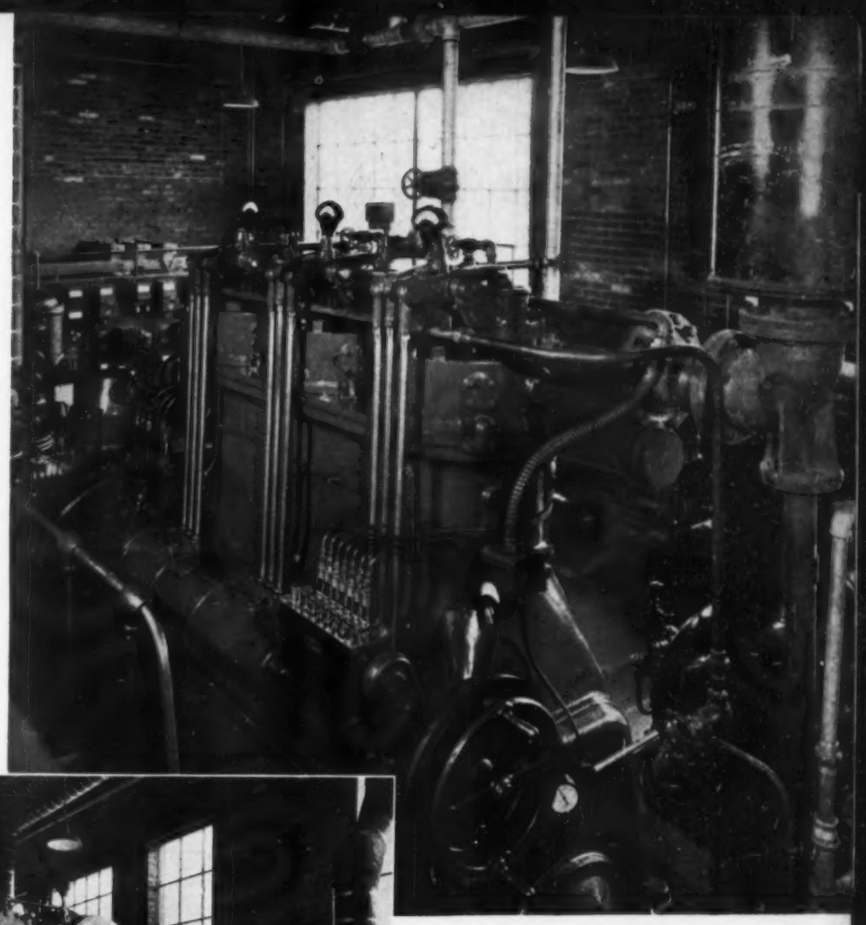
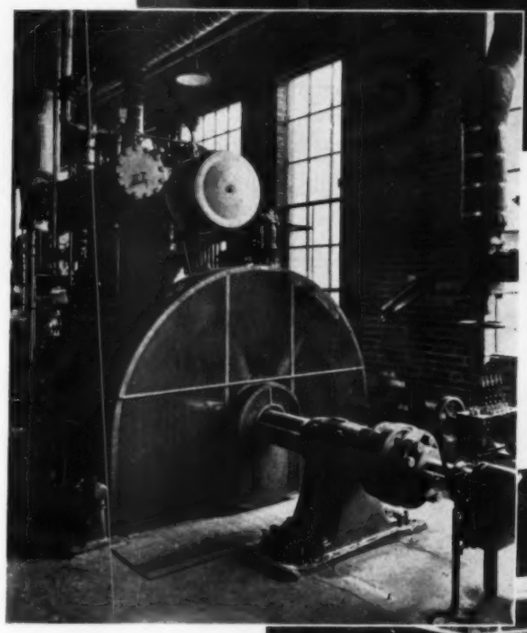
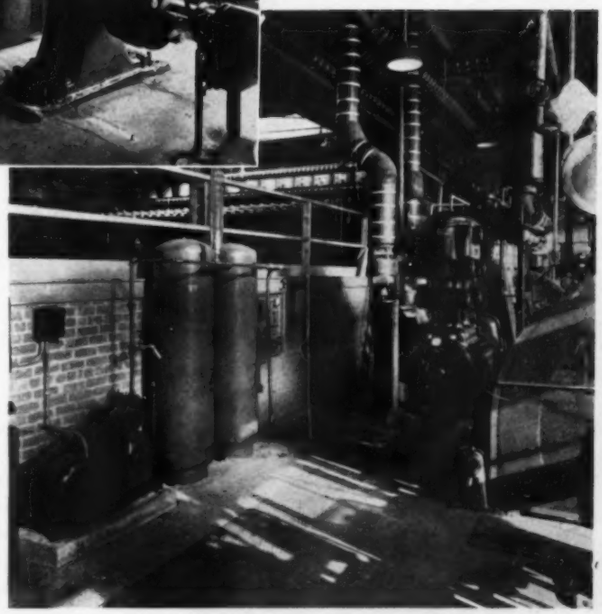




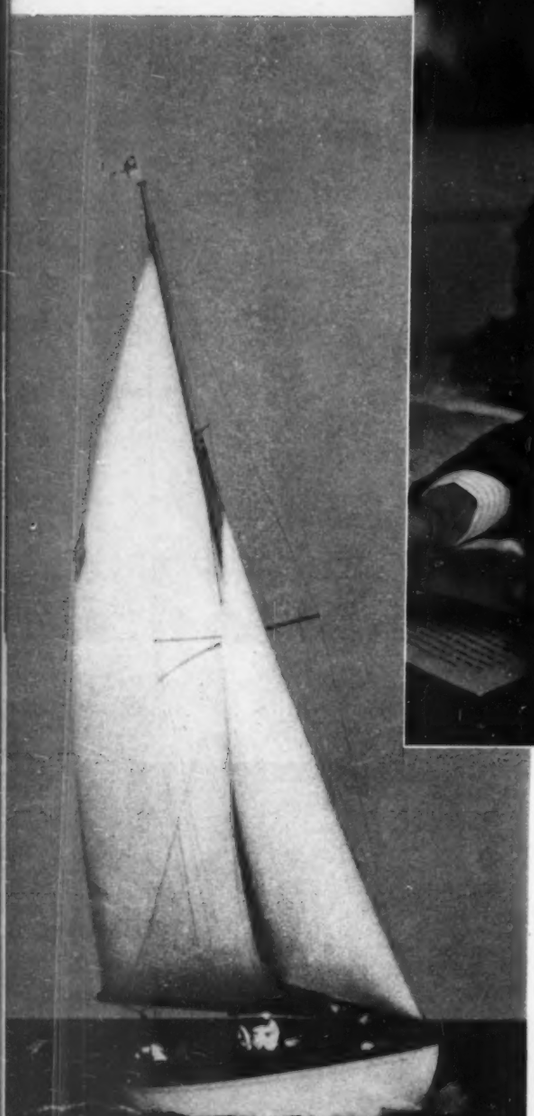
Both Chicago Pneumatic Diesels are equipped with Alnor pyrometers and Motoco distance-reading thermometers.



Auxiliary equipment includes Thomas flexible couplings, a Quincy starting air compressor and Burgess mufflers on both intake and exhaust.

BOAKE'S BOAT

The Diesel Auxiliary, "Olive IV."



AMONG the new auxiliaries that came out last Summer was the *Olive IV.*, for Boake Carter, well known Philco radio commentator, from the designs of Thomas D. Bowes, M.E., of Philadelphia. The new boat was built by the Mathis Yacht Building Company, Camden, New Jersey, under the designer's supervision and is of the following dimensions:

L. O. A.	46′ 6″
L. W. L.	35′ 8″
Beam	13′ 6″
Draft	3′ 9″

This sloop is Marconi rigged, with permanent backstay. It has a total sail area in the jib and mainsail of 920 square feet, 676 square feet in the mainsail and 244 square feet in the jib. The power plant is considerably larger than usual. It consists of a 6-cylinder 65 hp. Buda Diesel engine, with V-drive and reduction gear, installed under the bridge deck forward of the cockpit.

The boat is of a husky type that can be used for cruising off shore and, at the same time, will be dry in bad weather. The arrangement plan has been worked out to provide good cruising accommodations for six people. There is a separate stateroom aft with a bath room on the port side with a shower, U. G. Lee electric toilet and wash basin. Opposite, on the starboard side is the companionway, lockers for suit cases and light sails, a chart locker and a Philco radio.

The main cabin is located amidships with a built-in berth and an extension transom on each side. It also contains large hanging lockers. There is an entrance to the bath room from the main saloon. Forward of the saloon is a galley, very roomy for this size boat, with a specially designed Webb range. The smoke pipe can be taken out of one end instead of the forward side, saving six or seven inches of floor space. The range burns either coal or kerosene. Forward of the galley is the crew's quarters for two men. The trunk cabin extends over the crew's quarters, so that they have full head room and good ventilation.

The boat is equipped with a separate generator; 32-volt Leece Neville generator driven from the main engine; large 32-volt heavy duty Philco marine battery of 102 ampere-hours which runs the windlass, electric toilet, ventilating fans, galley exhaust, bilge and fire pumps and American Engineering electric capstan; 24-volt Philco Diesel starting battery, capacity of 160 amperes for 20 minutes and a 6-volt Philco radio battery, capacity of 157 ampere-hours, which operates the Philco radio. Sails, including ballooner, spinnaker, Genoa and storm jib, were made by Ratsey & Lapthorn, Inc.

The *Olive IV.* carries a dinghy on hinged davits, equipped with a Johnson outboard motor, an electric searchlight and a complete set of electric ventilating and exhaust fans. The steering gear is of the Ross cam-type. She also has a Kenyon log and a special type binnacle and compass by Hand of the devistat type. All the ballast is lead and is carried inside. The piping is copper and brass with Mueller fittings. The fire system is a C. O.² with heads in the engine room and galley. Russell Stoll water-proof fittings were used for all the electric outlets on deck.

The boat is finished in the very best possible manner throughout, with teak decks and teak joiner work outside.

A NEW UNIT FUEL INJECTOR

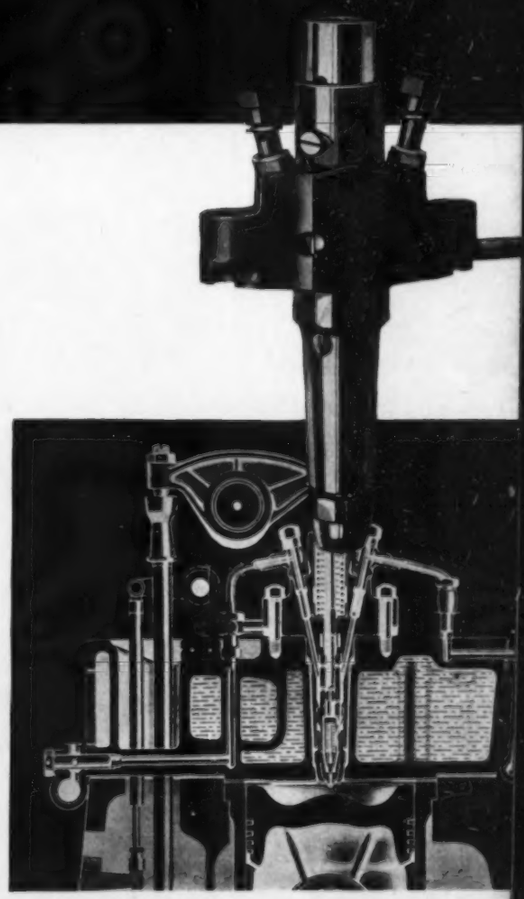
By JOHN W. ANDERSON

DIESEL driven streamlined railroad trains caught the public attention from the very beginning. Many of the Diesel engines have been built for this service by the Winton Engine Corporation, and one of the most important items contributing to their success has been the unit fuel injector developed for this purpose. Based upon this experience, Winton engineers have developed comparable units for smaller engines, suitable for the average pleasure craft, and details of the system have now been released for the first time.

This new injector combines all of the elements required for fuel injection into one unit, and one of these individual injector units is fitted to each cylinder of the engine. It is designed especially to give the even pressure and complete atomization of the fuel needed for complete combustion.

These unit injectors are now installed in the Model 233-A 200 hp. and Model 241 eight cylinder engines exhibited at the 32nd annual National Motor Boat Show in Grand Central Palace, New York, January 8 to 16. Among the yachts already powered with the new type engines are the 101 ft. *Gem*, owned by William Ziegler, Jr.; the *Consort IV*, a 90-footer, owned by T. Monroe Dobbins; the *Alma F.*, a 75-footer owned by Alfred J. Fisher; the 65 ft. motor sailer *Devshir*, owned by Louis E. Emerman; the *Helen H.*, a 74 ft. yacht, owned by T. A. Hughes, and a new 92½ ft. yacht recently launched for a prominent Eastern yachtsman.

These new unit injectors have several notable features. There are no long high pressure pipe lines from the high pressure pumps in



A close-up of the new injector assembly, a cross-section showing it in relation to the cylinder head and (above) the injector in action.

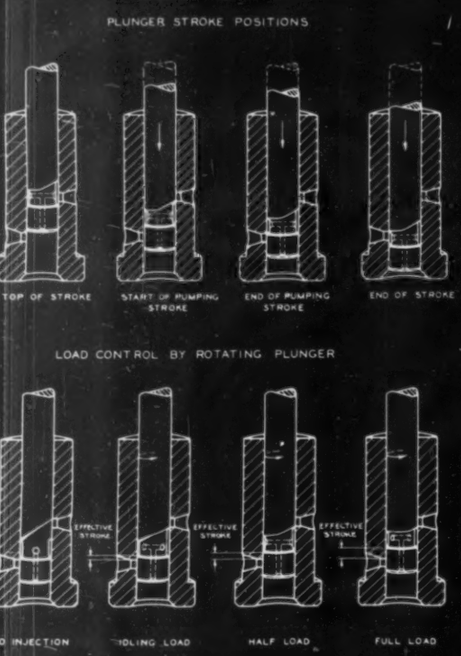


Fig. 4 Bushing with Various Plunger Positions

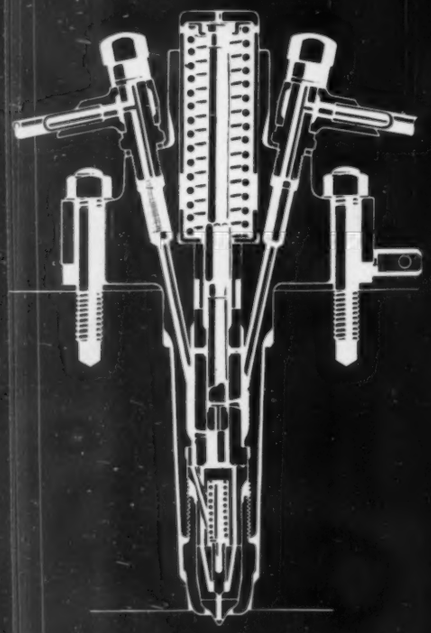


Fig. 3 Cross Section of Model 233 Injector

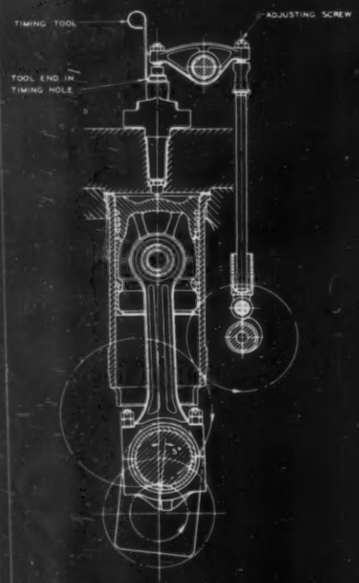


Fig. 5 Timing Injector Plunger Stroke with Engine

Devshir, another prominent pleasure craft driven by Winton Diesels. In this case it is a six-cylinder 150 hp. unit turning 1,200 rpm. A two to one reduction gear gives proper propeller speeds.

which must be maintained as uniform a pressure as possible to suit the operating conditions. Since the fuel injection pressure is confined to a small portion of the injection unit, injection pressures up to 20,000 pounds per square inch or more may be used, which permits better atomization. In the conventional systems, pressures above 10,000 pounds are seldom permissible. Should a nozzle become fouled or plugged in any manner, it may be removed, cleaned and replaced in much the same manner as a spark plug would be handled in a gasoline motor.

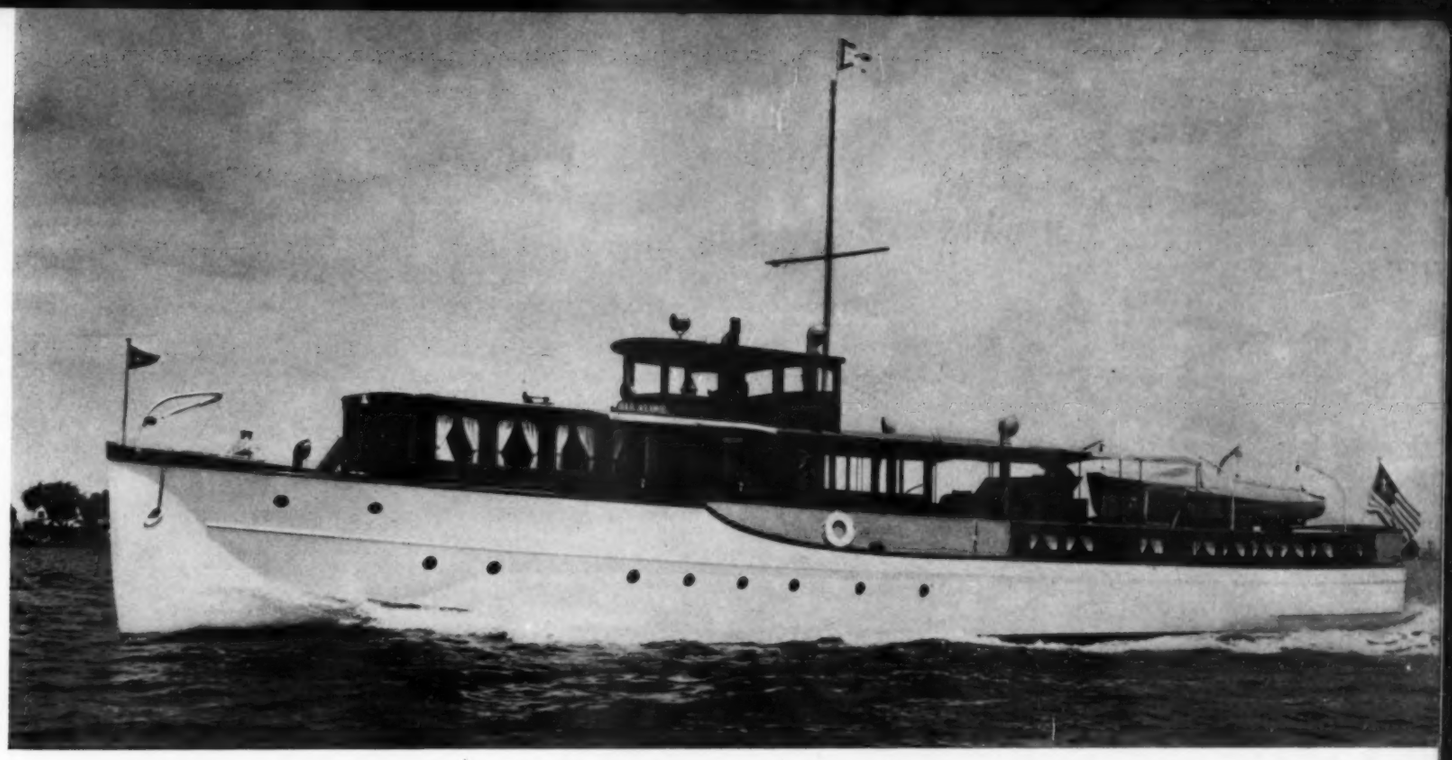
These injector units are located in the cylinder head and are actuated in much the same manner as the valves in an ordinary overhead valve automobile motor, through push rods and rockers from the camshaft. This assures correct timing of the fuel injection. With the high even pressure behind the nozzle, the charge of fuel is sprayed into the combustion chamber in every direction, giving proper distribution to every part and assuring clean, even burning.

The operation of the injector will be understood by referring to the illustrations. In Figure 3, fuel is supplied at a pressure of about 20 pounds per square inch and enters near the top at the left hand side of the body. After passing through the filter in the inlet passage, the fuel fills the annular supply chamber around the bushing. Surplus fuel supplied flows out through the outlet passage on the right side. Fuel supply pressure in the injector is maintained by the small hole in the restriction plug placed in the outlet drain manifold.

As the plunger is moved downward by the rocker arm, fuel in the bushing chamber is first displaced through the lower port into the supply chamber until the lower edge of the plunger closes this port. Fuel is then displaced through the central and transverse holes in the plunger and through the upper port into the supply chamber. Further downward movement of the plunger causes the helical upper lip to cover the upper port, and the fuel in the bushing chamber is then forced down through the passages in the spring cage and the needle guide to the annular space around the spring loaded needle valve. Acting on the stepped area of the needle valve, the fuel pressure builds up until it lifts the needle off its seat, when the fuel passes into the spray tip and is forced through the orifices into the combustion space in the cylinder.

Injection continues until the lower lip on the plunger uncovers the lower port in the bushing, and then the fuel bypasses up through the holes in the plunger and through the lower port into the supply chamber. This releases the pressure of the fuel in the bushing chamber, and the needle valve spring closes the valve. On the return stroke, the upward movement of the plunger fills the bushing chamber with fuel oil which flows from the supply chamber through the lower port.

In addition to this reciprocating motion which pumps the fuel, the plunger has a rotary motion which varies the amount to suit the load. In Figure 4, the upper diagrams show the stroke positions and the lower diagrams the rotary positions. The former show that the total downward stroke is divided into three



George W. Codrington's 95 foot yacht "All Alone" powered by two 200 hp. Winton Diesels equipped with the new injectors.

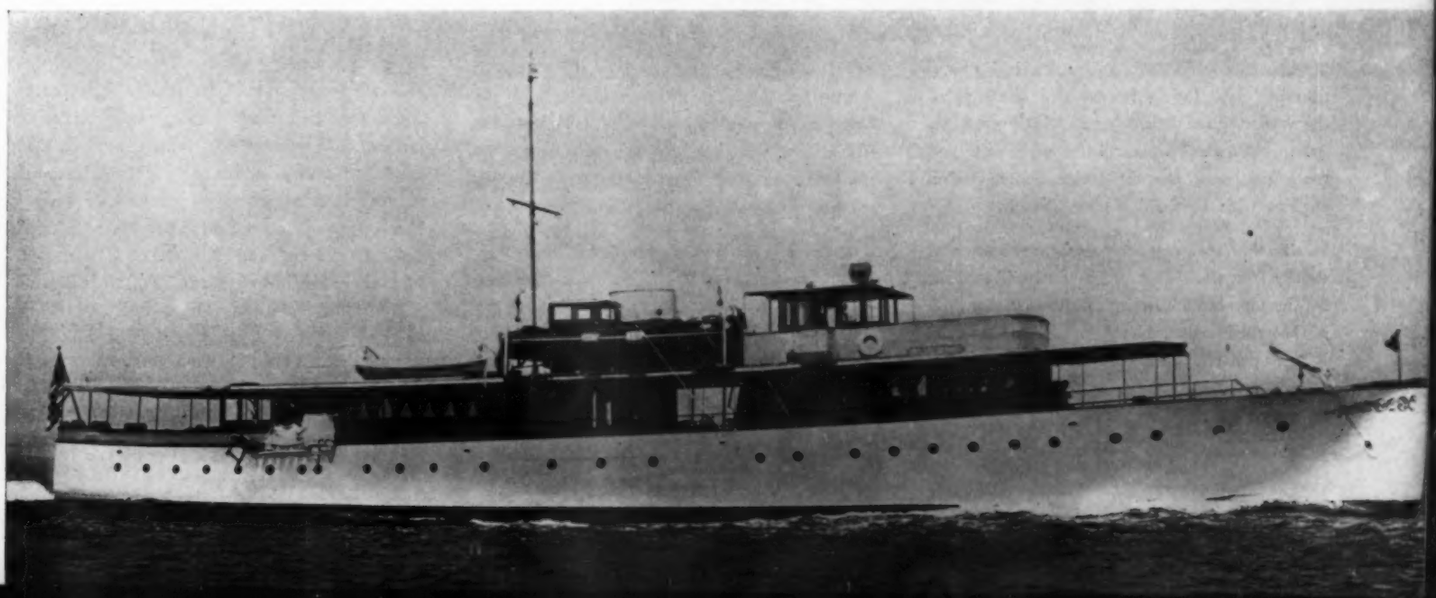
parts. The first or upper part allows acceleration to the required plunger velocity before pumping begins. The second part controls the quantity of fuel injected. The third or overtravel part slows down the velocity to the end of the stroke.

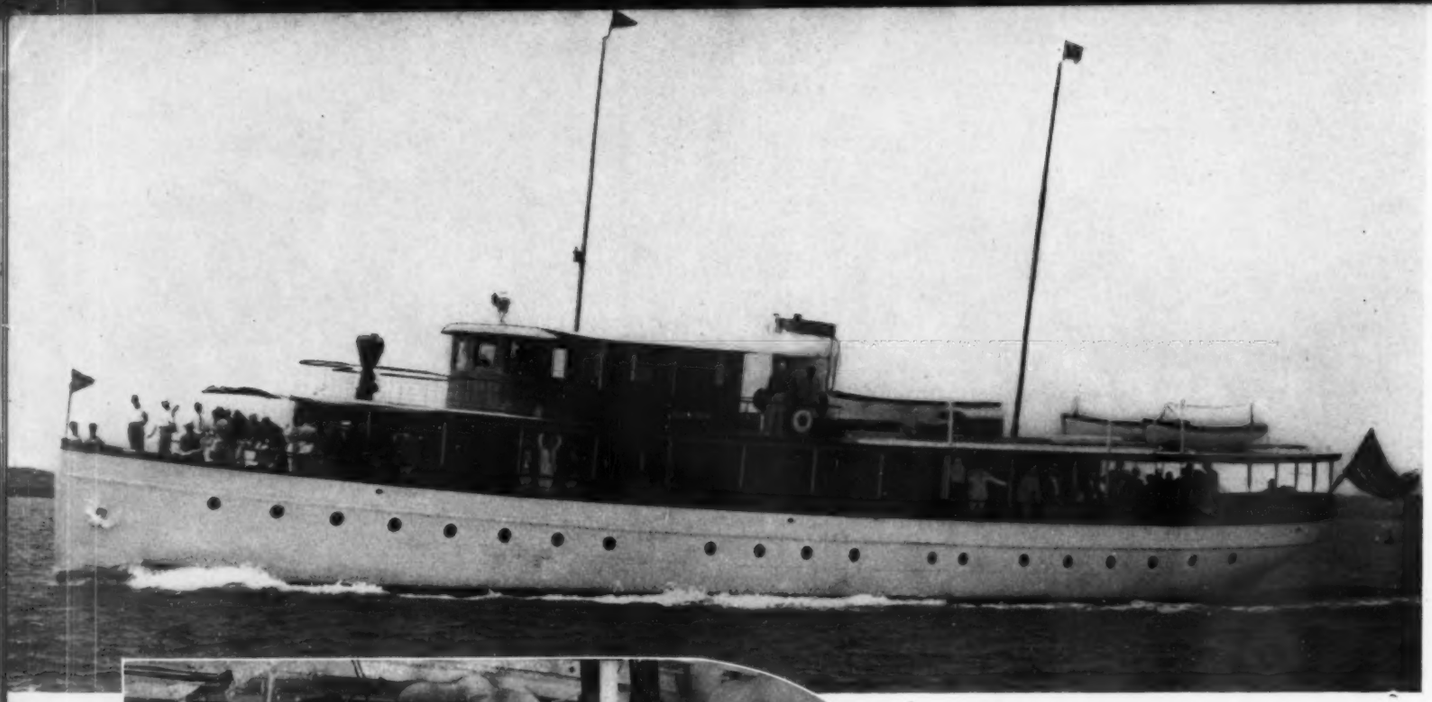
The lower diagrams show how the distance from the lower lip to the lower port is varied by rotating the plunger, with the resulting variation in the effective pumping stroke. A gear on the reciprocating plunger and a rack connected to the governor or throttle rotate the plunger and control the fuel supply as shown in Figure 3.

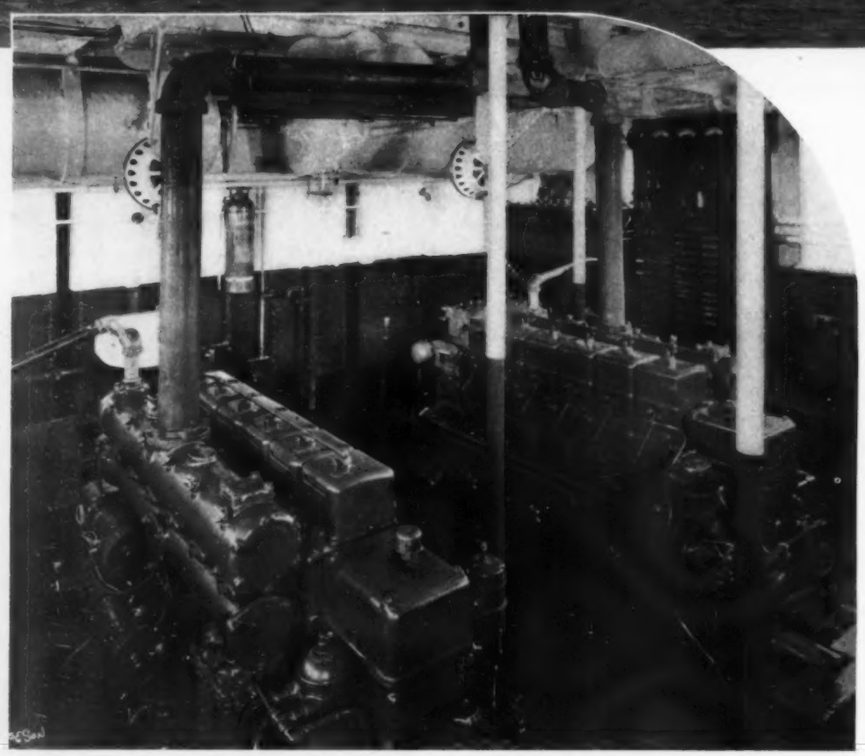
But in marine work, as the quantity of fuel injected increases, so does the speed, and the injection should begin earlier. This is accomplished automatically, as shown in Figure 4. The pumping part of the stroke begins when the helical upper lip on the plunger covers the lower edge of the upper port, and rotation of the plunger so as to increase the effective pumping stroke also makes it begin earlier in the cycle.

The spring loaded needle valve performs three important functions. First, it serves as a check valve between the combustion chamber and the injector. Second, it gives positive control over the start and stop of the fuel spray into the cylinder. Third, it provides the necessary atomization of the fuel for prompt ignition at all speeds, because it cannot open until the fuel pressure has been built up high enough to compress the spring. Since atomization is a function of velocity which comes from pressure, this insures proper atomization even at low speed and light load. Once the valve is off its seat, the injection pressure becomes a function of the relative velocity of the plunger and the area through the orifices, and this varies with the speed of the engine. Prompt ignition of the first part of the spray brings combustion of the remainder as it enters the cylinder. Thus the combustion pressure can be controlled by the shape of the injector plunger cam.

"Navigation," one of the United States Government's official vessels, is also Winton Diesel powered.







DIESELS TRANSFORM "ALURA"

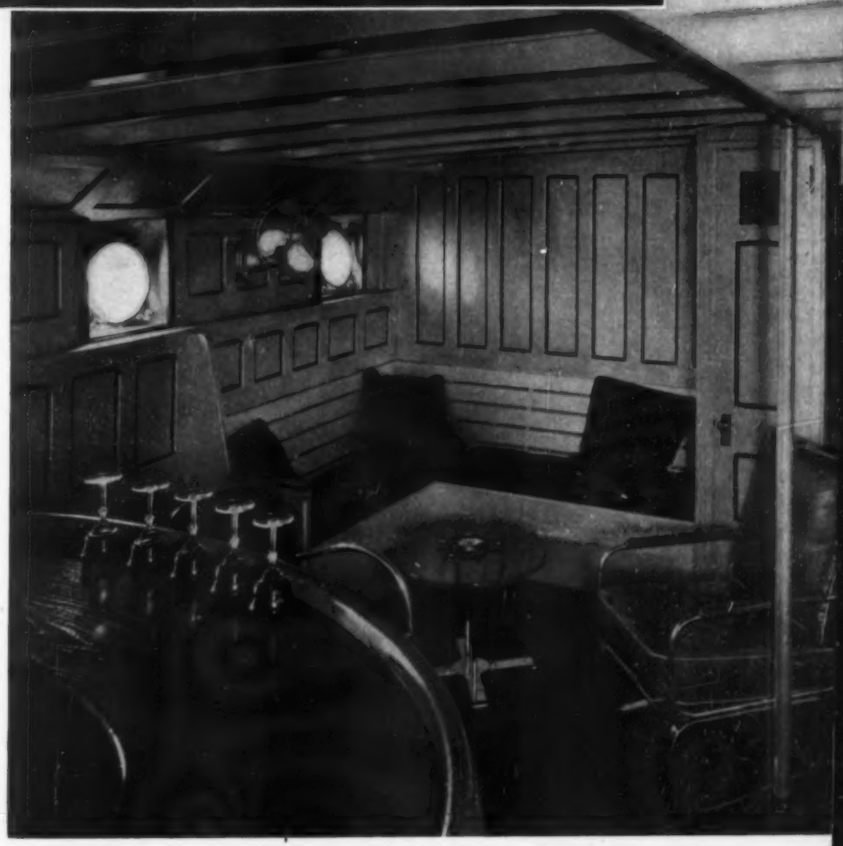
By E. SCHOONMAKER

The spic and span engine room where economical Fairbanks-Morse marine Diesel engines have supplanted gasoline engines.

A FACE-LIFTING job and gland operation increased the usefulness and efficiency of the yacht *Alura,* owned by E. W. Coppage, of Atlantic City. This consisted of a complete renovation and the replacement of gasoline engines with Fairbanks-Morse Diesels.

Until a few years ago, the *Alura* was known as the *Symphonia.* This yacht was built in 1922 by the Consolidated Shipbuilding Corporation of Morris Heights, New York, for Mr. John Ringling of circus fame. For years he and his family used the vessel for long trips up and down the cost and on inland waters. Mr. Coppage, the present owner, is making extensive use of the boat throughout the year by chartering it out. It is in Florida again this winter.

The *Alura* is a steel hull, finished off with teakwood, measuring 120 x 20.3 x 9.2, which accounts for her staunchness and spaciousness. The interior is finished with home comforts, having all the shore conveniences one would expect in a floating palace. In this regard, the master's room, single and double staterooms, connecting baths and sanitary facilities; cocktail bar and quarter deck lounge excel in furnishings, arrangement and accommodations. Nothing was forgotten for comfort or safety. Showers, towel lockers, medicine chests, electric fans, telephones and fire alarm stations all have their appointed places. This is also true of an 18 ft. motor launch, two 12 ft. rowing tenders, an 18 ft. Chris Craft speed boat and life raft, which are quartered on the boat deck.



The *Alura* will accommodate fifteen overnight guests and has a passenger capacity of sixty-five.

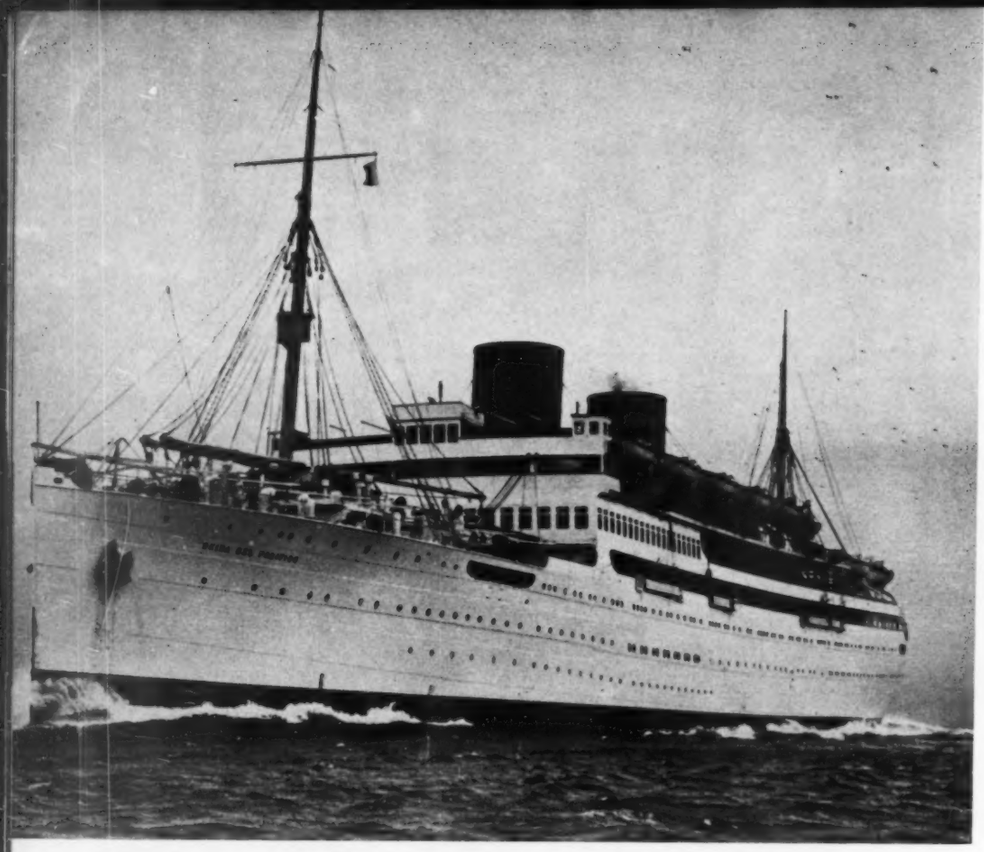
In the days when John Ringling used the yacht, operating costs were of little consequence. However, the storage and use of large quantities of gasoline for the engine was a constant source of danger. When Mr. Coppage took possession, the safety problem became his first concern. This necessitated overhauling the engine room and making replacements.

The 180 hp. gasoline engines were taken out. Without much change in engine beds, two Fairbanks-Morse 120 hp. Model 36 Diesels were installed. This provided a greater safety factor, more cruising radius and economy of operation, with no material reduction in speed. The Diesels are fitted with 3:1 reduction gears, swinging two 40 x 43 4-blade propellers which gives the *Alura* a speed close on to 15 miles an hour. The other engine room equipment consists of Alnor exhaust pyrometers and two 7½ kw. generator sets for power, lighting and charging a 100 cell Edison battery. This assembly of operating equipment makes an ideal installation. The engine room is large and attractive.

During the trial trip from Salisbury, Maryland, to Atlantic City the *Alura* covered three hundred miles in thirty hours. Operating at moderate speed while they were being run in, the engines showed a remarkably low fuel and lubricating oil consumption. This amounted to 25 cents an hour for each engine. Since that time many trips have been made up and down the coast. After one year's operation, the engines are just as economical and reliable as when first installed. On charter during the month of August, the *Alura's* log showed that the Diesel had operated for a period of 120 hours with a fuel and lubricating oil cost, including galley stove requirements, of 30 cents an hour for each engine. Assuming it cost 5 cents an hour to fuel the stove, the cost of operating the engines was no greater than on the trial trip.

Those who have enjoyed the pleasure and comfort of yachting on the *Alura* will never forget it. This is a fact that many local Jersey friends of Mr. Coppage can bear witness to.

New Diesels, and the renovations described, brought about a great change in the *Alura*. Among the compliments received by Mr. Coppage, the most enthusiastic have come from those who have chartered her. This is, of course, a splendid tribute to her fitness.



M.S. "Reina del Pacifico" powered with four 5,500 bhp. supercharged Harland & Wolff B. & W. Diesel engines.

SUPER-CHARGING THE DIESEL

By B. J. VON BONGART

WITH the beginning of the present century, when the internal combustion engine was just about emerging from the kindergarten stage, technicians sought to improve the performance of such engines – by supercharging. The more advanced theorists of that period realized that a great deal of heat – i.e., power – passed away unused with the exhaust, and it was but natural for clear thinkers to cogitate that the exhaust gases might by used for driving a turbine wheel directly coupled to a centrifugal blower. Thus the power derived from the exhaust gases, acting upon the turbine, would operate the blower which would then furnish compressed air.

This was a clever thought, and once it got abroad, numerous inventors played with the idea. It seemed so simple, so fascinating, but as with most new ideas, it first had to pass through various phases of development before it could be adopted in practice; i.e., until the results obtained warranted the commercial exploitation of the idea. So while theorists were cluttering-up the archives of Patent Offices with inventions pertaining to supercharging internal combustion engines; to the rank and file of engine technicians supercharging was merely an abstract theory, and to the general public, a *terra incognita*.

In 1909, the Swiss engineer Büchi compiled a complete resume of the various suggestions up to then made relative to supercharging internal combustion engines, using the material buried in Patent Offices as his data. His technical treatise upon the subject* created a sensation amongst the technicians of that time.

But not until 1911 were actual successful tests made with supercharging. Büchi, as the chief-research-engineer of Sulzer Bros. of Winterthur, Switzerland, ran a series of tests at the above plant, using low pressures as well as high pressures up to 30 lbs. per square inch. The combustion pressures obtained were in excess of 1,400 lbs. per square inch, net-

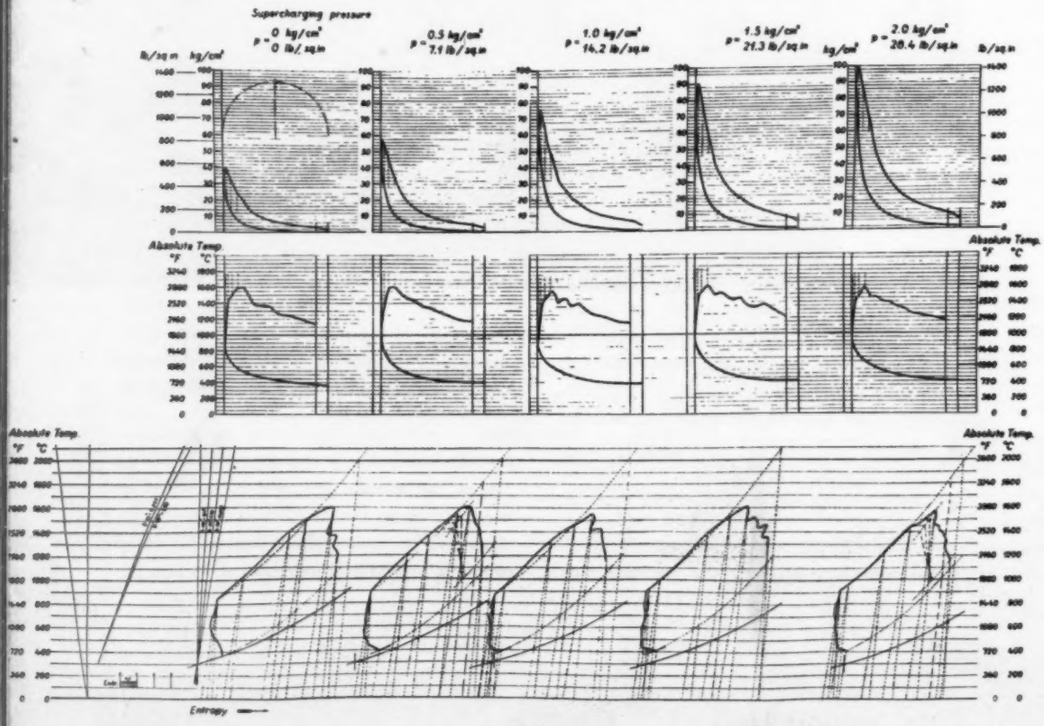

Supercharging pressure
0 kg/cm² p = 0 lb/sq.in
0.5 kg/cm² p = 7.1 lb/sq.in
1.0 kg/cm² p = 14.2 lb/sq.in
1.5 kg/cm² p = 21.3 lb/sq.in
2.0 kg/cm² p = 28.4 lb/sq.in
Absolute Temp.
Entropy

Figure 1

Fig. 1 – Indicator, temperature and entropy diagrams of the first Diesel engine equipped with an exhaust-gas turbo-blower for supercharging and scavenging.

Fig. 2 – Weak-spring indicator cards taken on the first Diesel engine equipped with an exhaust-gas turbo-blower.

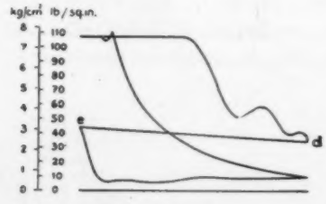


Figure 2

*Alfred J. Büchi, *Ueber Verbrennungskraftmaschinen*, in the *Zeitschrift fuer das gesamte Turbinenwesen*, vol. 6, 1909, pp. 313, 329, and 347.

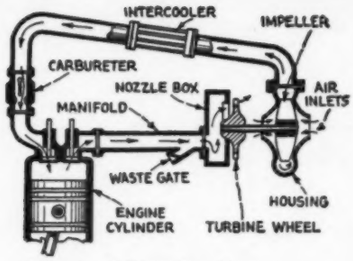


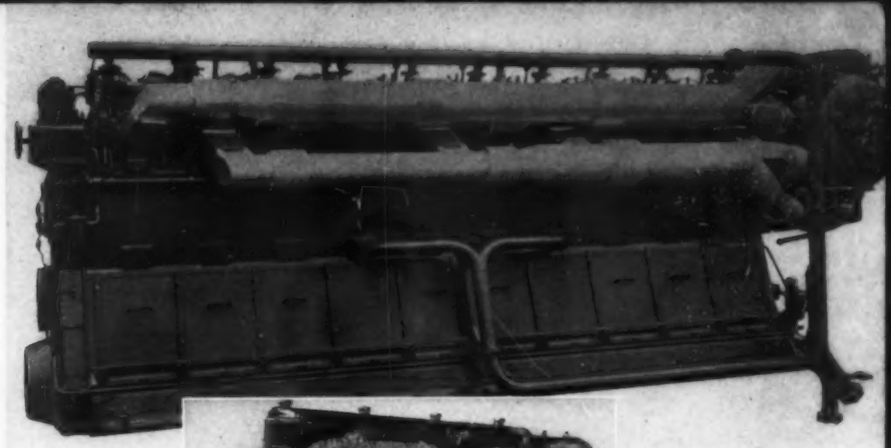
Fig. 4 — Schematic diagram exhaust turbine driven supercharger.
(Courtesy Materials Division, U. S. Army Corps.)

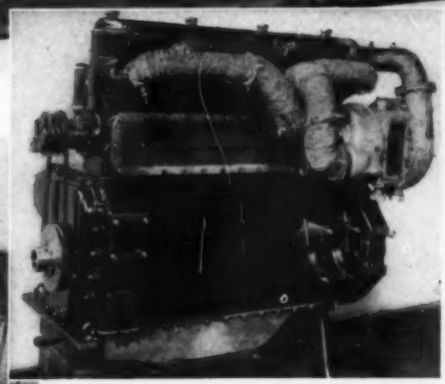
ting a brake-mean-effective pressure exceeding 200 lbs. In Fig. 1 are shown the indicator, temperature, and entropy diagrams of these tests for supercharging pressures of 0, 7.1, 14.2, 23.3, and 28.4 lbs. per square inch.

These experiments proved, if anything, that the fuel consumption could be improved with exhaust turbo-drive, but the influence of the steam-turbine practice is clearly apparent, in that an attempt was made to keep the exhaust-gas at a constant pressure ahead of the turbine wheel. The complete abandonment of the constant-pressure theory is perhaps more than anything else responsible for the present-day success of the exhaust-gas turbo-blower for supercharging. The weak-spring diagram of Fig. 2, line *d-e,* shows that the exhaust pressure during escape into the turbine was practically constant.

Because of the low efficiencies of the exhaust-

. . . . *And now please turn to page 58*





M.A.N. 10-cylinder, 1,600 hp. with Buchi supercharger attached.

Saurer automotive Diesel with Buchi supercharger attached rated 150 hp. unsupercharged and 225 hp. supercharged.

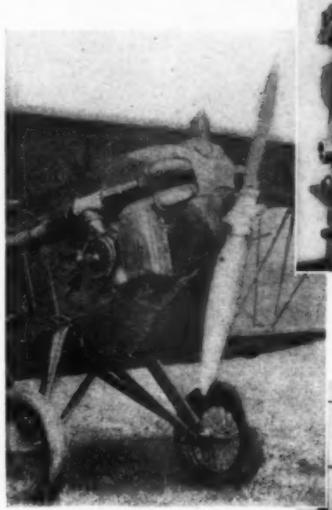
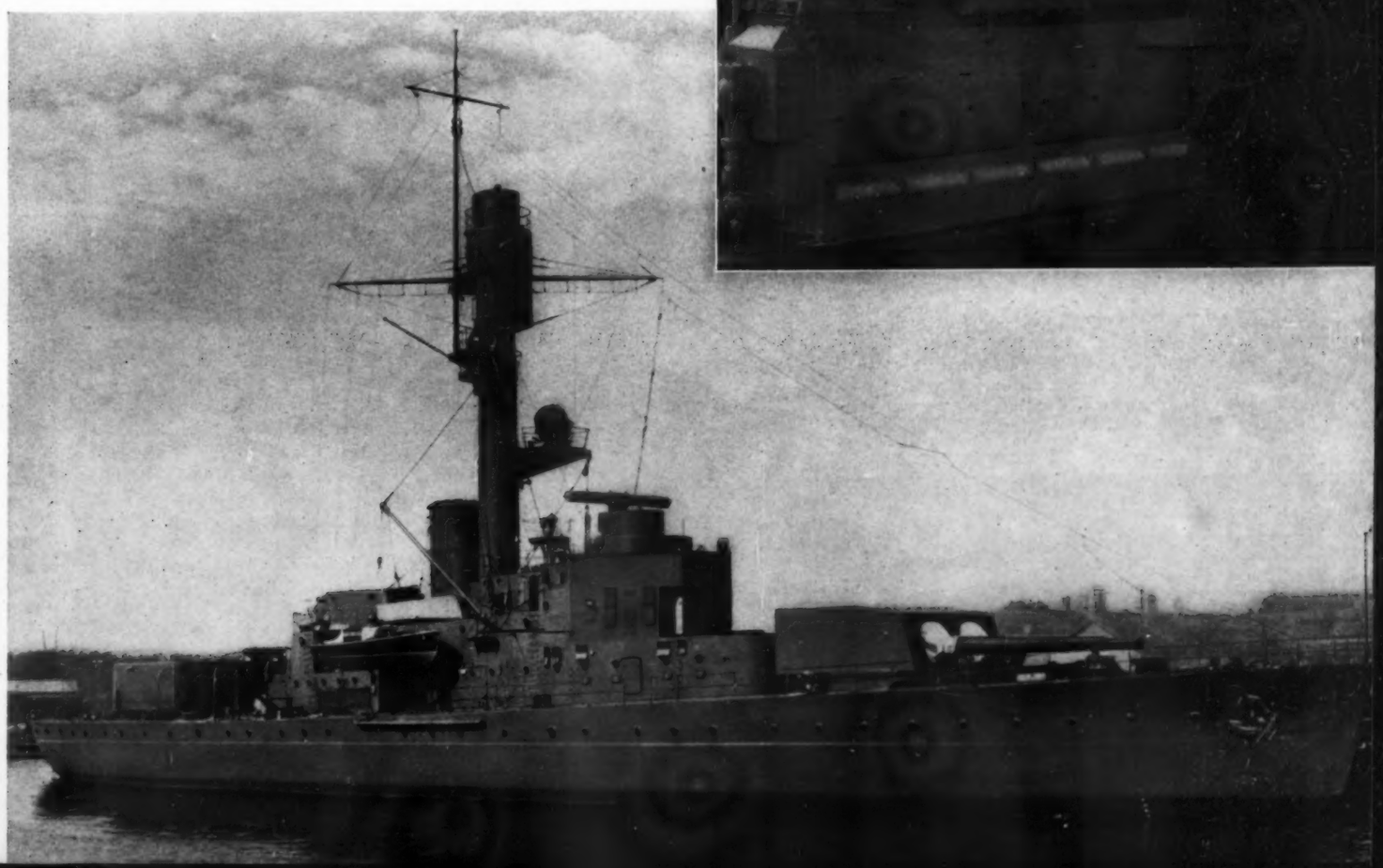
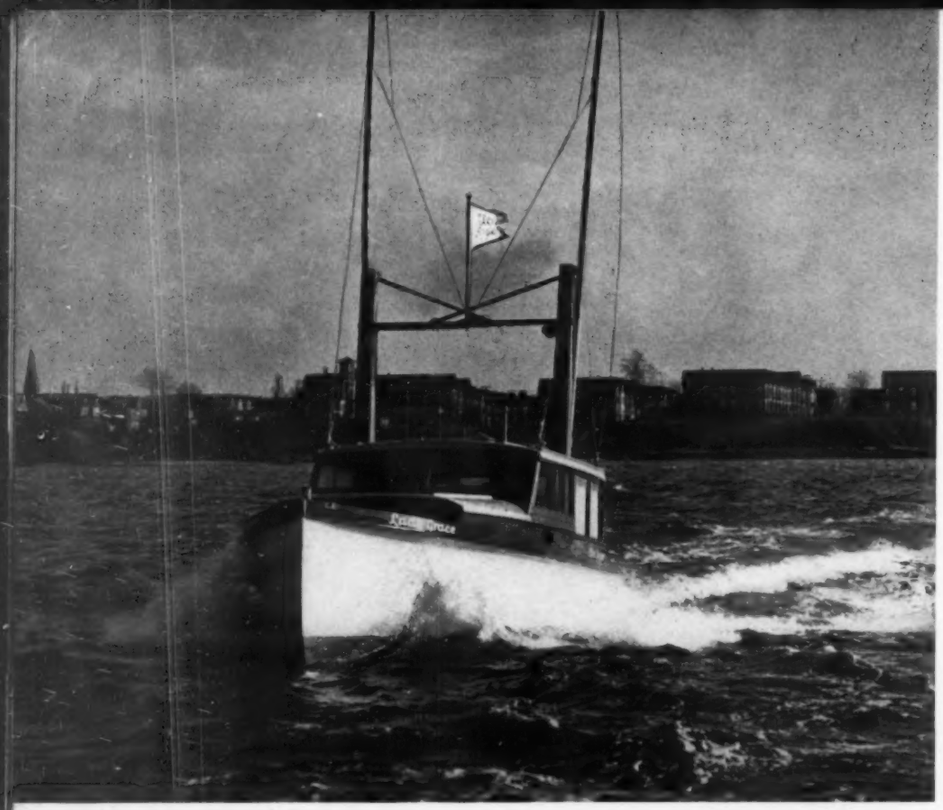


Fig. 3 — Pursuit plane with supercharged motor.

6-cylinder 12½" x 13", 600 hp. locomotive type engine built by the American Locomotive Company, output of which increased to 900 hp. by Buchi-Brown-Boveri supercharger.

Finland Navy Coastal Cruiser "Ilmarinen" powered with four 1,200 hp. supercharged Diesel engines.





Capt. Gifford's Diesel Angler 38. Specially designed by Elco for Captain Tom Gifford, world-famous fishing guide, the "Lady Grace" represents the last word in fishing cruisers. She is powered with two 6-cylinder Buda Diesels, Type 415, 85 hp. each—installed with Elco's exclusive rubber mounting and Elco sound-proofing. A unique feature of this new Elco 38′ Angler is her overhead exhausts—the outlets for which also serve as standards for the outriggers.

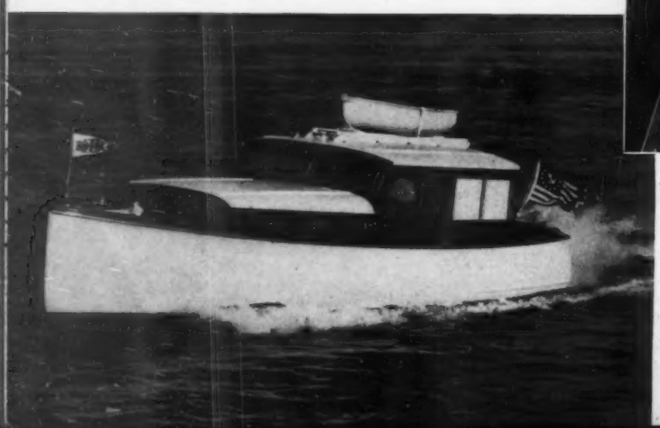
Elco
CRUISERS

America's Leading Cruisers now offered with Diesel Power

PURCHASERS of Elco Cruisers can now enjoy all the benefits of Diesel Power in their boats—the greater economy (fuel cost less than 3c a mile), increased cruising range, and absence of fuel fire hazard. Elco has perfected the installation of Diesels for even small cruisers, thanks to the experience of the parent company, The Electric Boat Company (which built the first marine Diesel Engines for commercial and naval vessels), and to two years of practical testing. The major problems of vibration and noise have been completely solved by Elco's patented suspension-type rubber engine mounting and Elco's sound-proofing. All Elcos are now offered with either gasoline or Diesel motors. Write for Catalogue F and prices.

In Hawaii. The "OIO," a Custom Cruisette 38 with Diesel power, built for Mr. John Waterhouse of Honolulu. The "OIO" is Mr. Waterhouse's third Elco, and was ordered with this type of engine for cruising and fishing among the Hawaiian Islands. Powered with two 6-cylinder Buda Diesels, Type 468, 85-100 hp., she has a cruising range of 1,000 miles.

A Diesel Yacht. The "Chimaera" (above), a luxurious 48′ Motor Yacht built by Elco for Mr. A. E. Archbold. Her power installation consists of two 100 hp. Superior 6-cylinder Diesels. The "Chimaera" saw extended service this past season on the St. Lawrence River with complete satisfaction to her owner.



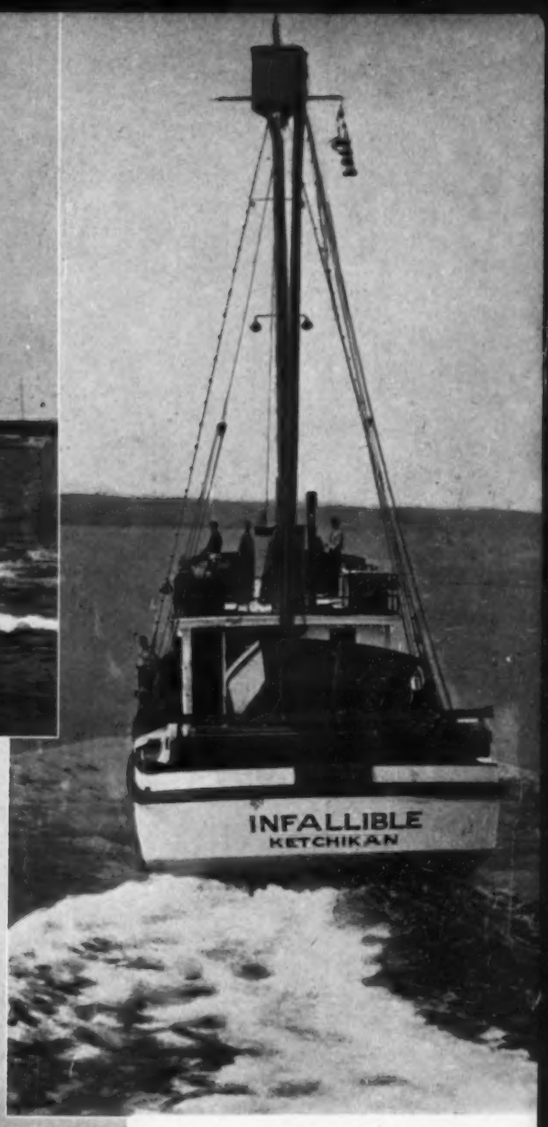
(At Left). A typical Elco Diesel installation. Two 85 hp. Buda Diesels installed on a Cruisette 38.

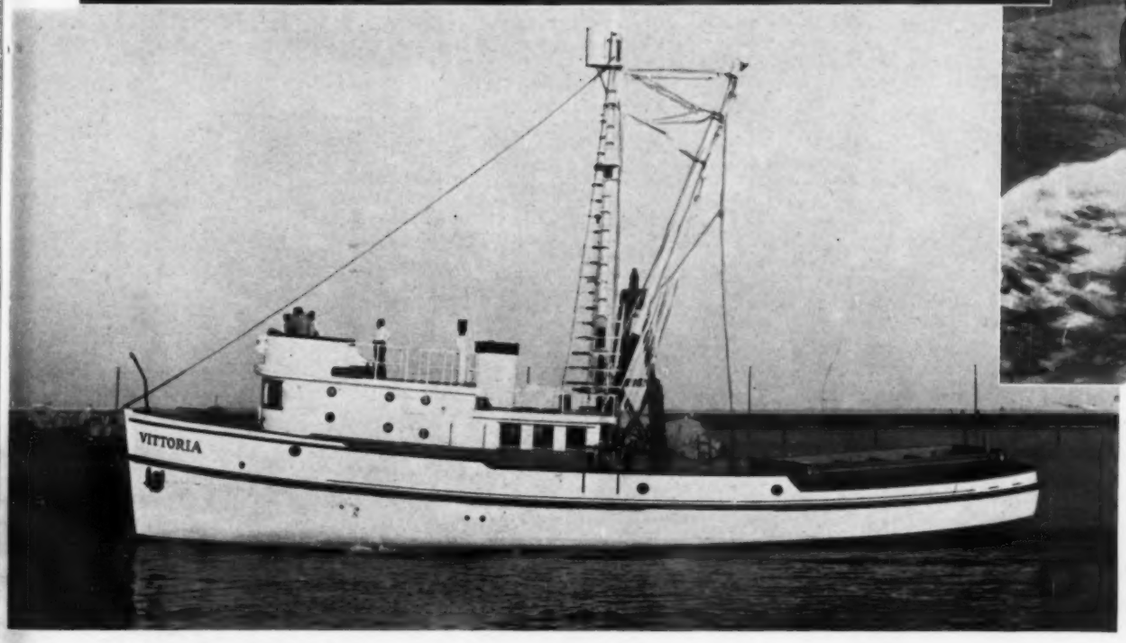
PORT ELCO

The Permanent Exhibit of Elco Cruisers

247 PARK AVE. at 46th St., N.Y.C. (WIck. 2-3830)

PLANT: THE ELCO WORKS, BAYONNE, N. J.





Three Atlas-Imperial powered Pacific Coast Sardine-Herring Seiners, the "Infallible," owned by A. W. Brindle of the Ward Cove Packing Company, powered with a 240 hp. 4-cylinder Atlas Diesel; the "Esperia," owned by Rosie Pugliese of San Pedro, powered with a 4-cylinder 10 x 13 Atlas Diesel; and the "Vittoria," owned by Vittoria Company of Monterey, Cal., powered with a 4-cylinder 240 hp. Atlas.

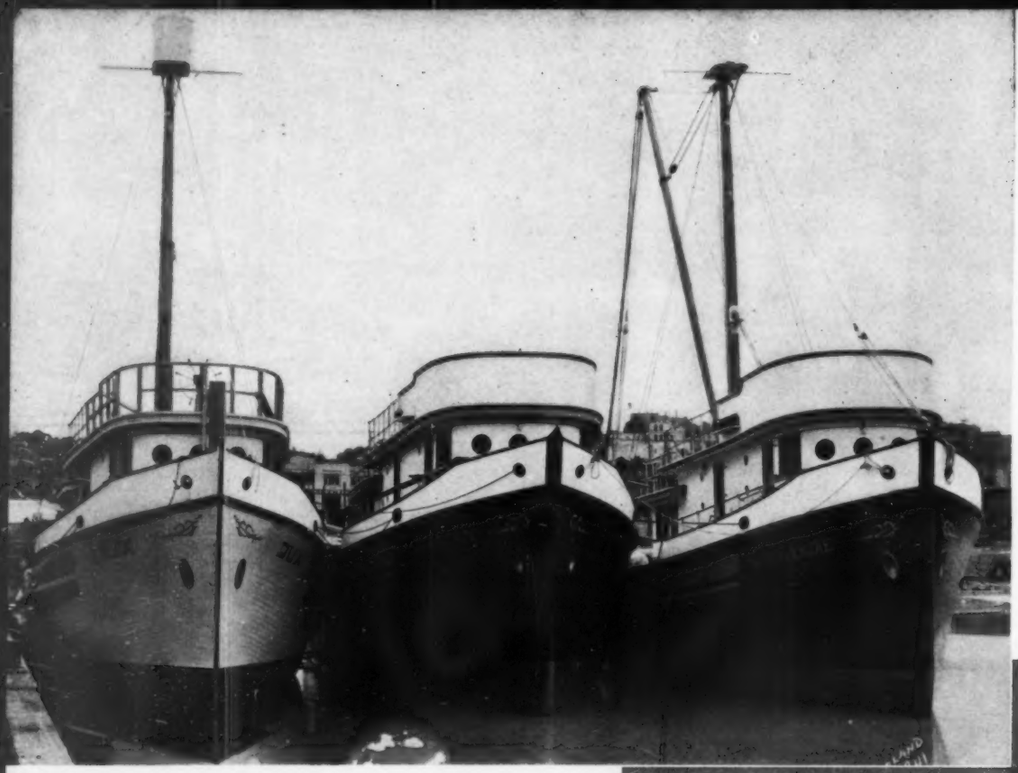
AMERICA'S LARGEST ALL-DIESEL FLEET

By CHARLES F. A. MANN

OUT on the Pacific Coast the commercial fisheries are Big Business. With the world's leading food fishes in abundance from Panama to the Bering Sea; a climate generally favorable for year round fishing, and a world-wide marketing system developed to handle the huge annual output, the Pacific Coast fishing industry is easily the world's finest and best organized, and the largest. Every race in the world that has produced real fishermen is represented in the huge fleets operating from Puget Sound, the Columbia River and California ports, as well as British Columbia and Alaska. All the Nordic and Slavic and Latin races of fishermen roam the Pacific in search of those huge catches that make fishing in the Western sea a business of rich one day and broke the next, though at the year's end, generally rich!

It is significant that the original "Pacific Coast Type" of fishing vessel, the Puget Sound Purse Seiner, still leads the procession and is now the LARGEST 100% DIESEL POWERED FLEET OF BOATS IN THE WORLD.

Without the Diesel engine in the husky wooden vessels the fleet comprising over 700 boats, the entire business would not be where it is today. Insurance rates would be prohibitive; fuel costs doubled, maintenance costs more than doubled and dependability the year round still a factor of chance that might wreck a season's fishing.

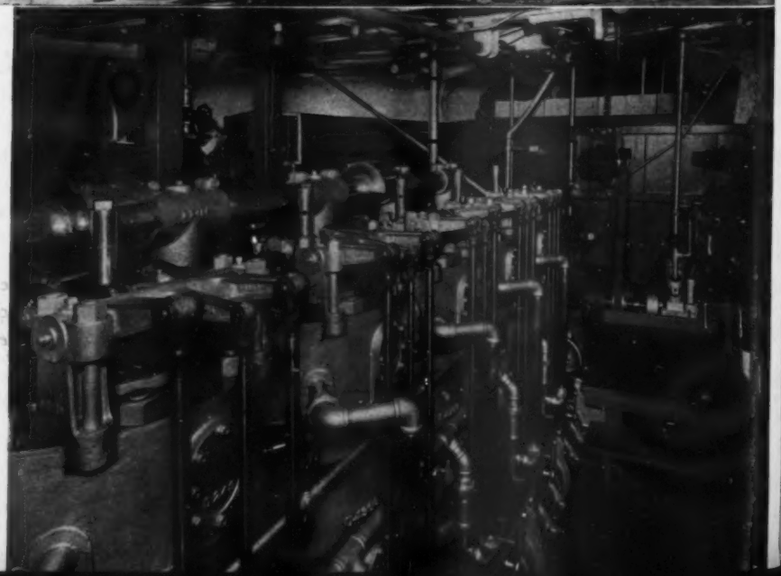


Three almost identical giant-type 80-foot Seiners just as they come from the launching ways – 75 per cent complete but minus stacks. These three boats came off the ways of Martinolich Shipbuilding Corp., Tacoma, within 10 days of each other.

There are six main types of fishing vessels used on the Pacific Coast. To avoid confusion, let it be stated that the Purse Seiner, with its 3,000 feet of net, with leads on the bottom and corks on the top, all piled on a turntable, with power rolls at the back and capable of swinging in a complete circle – is a unique and distinct type of fishing craft that goes up to Alaska for Salmon – whole schools of them encircled with a quick run to play out the net from behind, then pull the cable, or "purse string" that makes a floating pouch that completely encircles the school of fish. This same handy boat can fish for herring in Alaska, go a 1,000 miles to fish for Mackerel or Sardines off California and back up to Puget Sound to

So much has been written about the romantic side of the Pacific fishing business since the movie business has discovered that glamor rides in the hold of a fishing vessel, and so many people on the Atlantic Coast still think in terms of "Trawlers" that relatively little is known about the larger economics of America's most picturesque business. To begin with, the Atlantic Trawler is an antique, as far as modern fishing practice goes. Your Western skipper with a husky, electric lighted, steam heated Seiner or Tuna clipper, with from 100 to 600 Diesel horsepower in his hold, ready to sail for a 3,000-mile cruise in the Pacific, laughs when you speak of the Atlantic Coast fishermen. They are 50 years behind, he says. Why look – there's the Photo-Pilot; the frigidaire in the galley; hot and cold running water and showers and electric lighted shaving mirrors for the crew; powerful searchlights for spotting nets, and a boat that costs $35,000 to $50,000 ready for the sea – those are the things we MUST have out here – and the things they HAVEN'T GOT back on the Atlantic.

"Dependable," 86 x 23 ft. Built by J. M. Martinac at Seattle plant, for Spiro Babich of Gig Harbor, Washington, powered with a 350 hp. Diesel engine built by Washington Iron Works of Seattle, Washington. As in all Pacific Coast boats of this type, the engine room is directly below the pilot house and remote controlled from there.



seine another variety of Salmon or drop to Los Angeles and catch a certain species of Tuna.

This is Type No. 1 — America's original and most adaptable type of fishing craft. There are nearly 700 of them, from 45 to 90 feet long.

Next we have, in line with spectacular types, the famed California Tuna Clippers, idolized by the movies. These crafts, about 125 in number, run from Los Angeles and San Diego, South to the Equator in search of fish. They generally have 400 to 600 Diesel horsepower on their propeller shaft, elaborate artificial refrigeration systems driven by large auxiliary Diesels, and bring home fish that sells for $140 to $170 per ton at the dock, after a 7,000-mile cruise in the South Pacific, and maybe gone weeks at a time.

So much for Type No. 2, the largest of the Coast boats, good for only one kind of fish, and costing over $100,000 to build. This entire fleet of 125 boats is 100 per cent Diesel powered.

Next we have about 1,500 little salmon trollers; then about 2,000 pint-sized Columbia River Gill Netters; and lastly the famed Seattle Halibut fleet of about 350 boats, run by the Scandinavians who swear by Copenhagen (Snoose) the Diesel engine and Seattle as their favorite winter resort! This vast fleet thumbs its nose at the Purse Seiners, but they are rapidly buying Diesels — *over 300 Diesels for this motley fleet of smaller boats were purchased DURING THE FIRST FIVE MONTHS OF 1936.*

The indefatiguable Purse Seiners work the year round. With Sardines (Pilchards) now selling for around $12 per ton, the rush is on to bale billions of these oily fish out of the sea and scoot to floating or shore reduction plants off Monterey and San Francisco, where the fish are converted to valuable oil and fish meal. All world records have been broken into 1,000,000 pieces in this business in the past 20 months. With Salmon prices booming, the seiners get rich in Alaska and on Puget Sound and on the B. C. Coast. Last summer was fine for them and next summer promises even better. The newest canned fish, Mackerel, is oversold all the time, so all the Mackerel they can seine out of the California branch of the Pacific Ocean is salable at good prices. Starting with a boat slightly over 40 feet long, powered with a small gasoline engine and limited to fishing Salmon for the canneries, the Purse Seiner has now evolved into a craft ranging from 70 to 90 feet long, from 19 to 24 feet beam and powered with from 135 to 350 Diesel horsepower. Their capacity is for a crew of from 8 to 12 and 150 to 200 tons of fish in their beamy hold aft, under the net turntable.

In the past year, 1936, nearly 60 new giant Purse Seiners have been completed, most of

. . . . *And now please turn to page 62*

Second generation of Martinolich family, oldest shipbuilding family on Pacific Coast. Left to right: John D. Martinolich, designer; Robert Martinolich, construction foreman; A. C. Martinolich, president and mgr.; A. Cosulich, gen. supt.; Carl Martinolich, mill foreman.

"Lina B" for R. D. Suryan of Anacortes, Washington, original skipper and designer of "giant" type Coast Purse Seiners. 300 hp. Washington Diesel.

Bow view of "Marettimo" — 77 x 20 ft. powered with a 200 hp. Atlas Diesel and owned by Spadero Bros. of Monterey, Cali.

ANOTHER NEW DIESEL FUEL MODEL ANNOUNCED BY ALLIS-CHALMERS

OF particular interest to crawler tractor users is the announcement by Allis-Chalmers of the new Model "S-O" Controlled Ignition tractor which has been added to their line of road machinery.

The "S-O" was developed to fill a need by contractors and highway departments for a dependable low compression Diesel fuel tractor in the class between the 49 hp. Model "K-O" and the 79 hp. Model "L-O," officials of the company said. They also emphasized the fact that the "S-O" is entirely new tractor in every detail and is in no sense a stepped-up version of other A-C models.

A new four-cylinder Controlled Ignition engine especially designed and built by Allis-Chalmers is used in the "S-O." The Controlled Ignition principle has been used in Allis-Chalmers Diesel fuel tractors for several years and has certain advantages over the high compression Diesel engine. It eliminates excessive weight and destructive vibration and assures complete, efficient combustion of Diesel fuel. Perfect, undelayed timing under all operating conditions prevents power wasting pre-ignition, Allis-Chalmer engineers report. It is interesting to note in this connection that the Milwaukee concern has been building combustion engines of all kinds for almost 90 years and is recognized as one of the largest in the industry.

Other features include a six-speed transmission with a truck-type gear shift which permits changing of gears without stopping the tractor. It is pointed out that this is a new feature in crawler tractor design which will materially reduce non-productive operating time. Truck frames are completely equipped with anti-friction bearings and roller bearings are used in all truck rollers and front idlers. Ground pressure is reduced and stability and traction increased through the use of wide track shoes included as standard equipment. A high degree of balance is apparent as a result of careful proportioning of weight, power and speed.

The "S-O" weighs 18,000 lbs. and observers who watched it during tests made for many months past say it is ideally suited to bulldozing, 8-yard scrapers, 10- and 12-foot graders and 8 to 12-yard wagons.

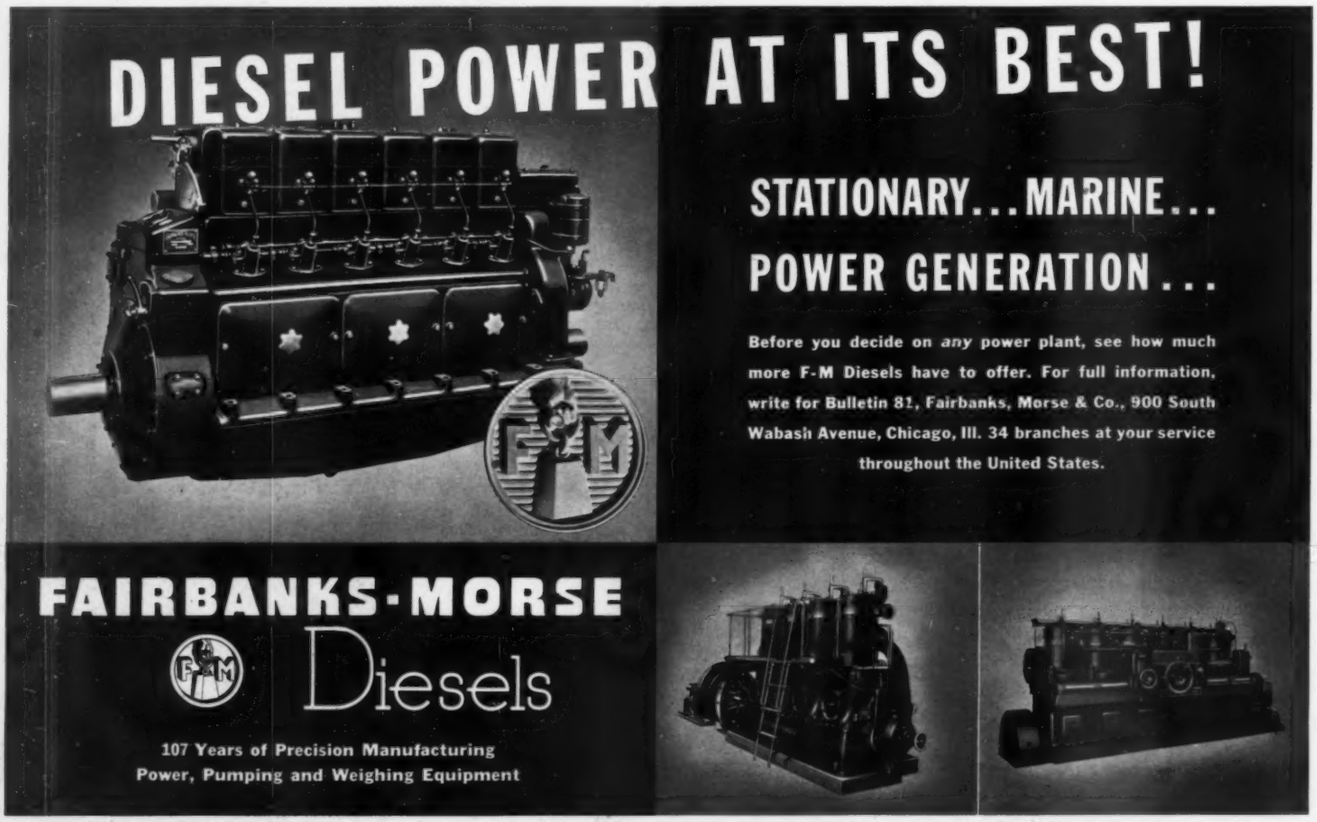
Complete information on the new tractor can be secured by writing the Editor.

BUDA DIESELS AT THE MOTOR BOAT SHOW

BUDA will exhibit the following Diesel models during the Motor Boat Show:

4-LDM-196-R; 6-LDM-275, 3½" bore, 4¾" stroke, 275 cu. in. displacement; 6-LDM-468, 4¾" bore, 5½" stroke, 468 cu. in. displacement; 6-LDM-91 and 6-LDML-691, 4¾" bore and 6½" stroke, with 691 cu. in. displacement; 6-LDM-909, 5¼" bore, 7" stroke, 909 cu. in. displacement; 6-LDM-1742, 6½" bore, 8¾" stroke, 1,742 cu. in. displacement.

Of these models, 4-LDM-196, the two 6-LDM-691's and the 6-LDM-1742 will be new. The outstanding engine of the Buda line for the coming year will be the 691. This engine will develop 120 hp. at 1,400 rpm., and 148 hp. at 1,800 rpm. It will be equipped with Bosch pump and will have a choice of reduction gears of 2.54 to 1 and 2.97 to 1. It will incorporate the regular Buda Lanova Silver Crown combustion features. The significant feature of the 909 engine is that it will be offered in matched pairs, a true right and left hand engine with all reciprocating parts matched and balanced, thus giving a perfect right and left for twin engine cruiser service.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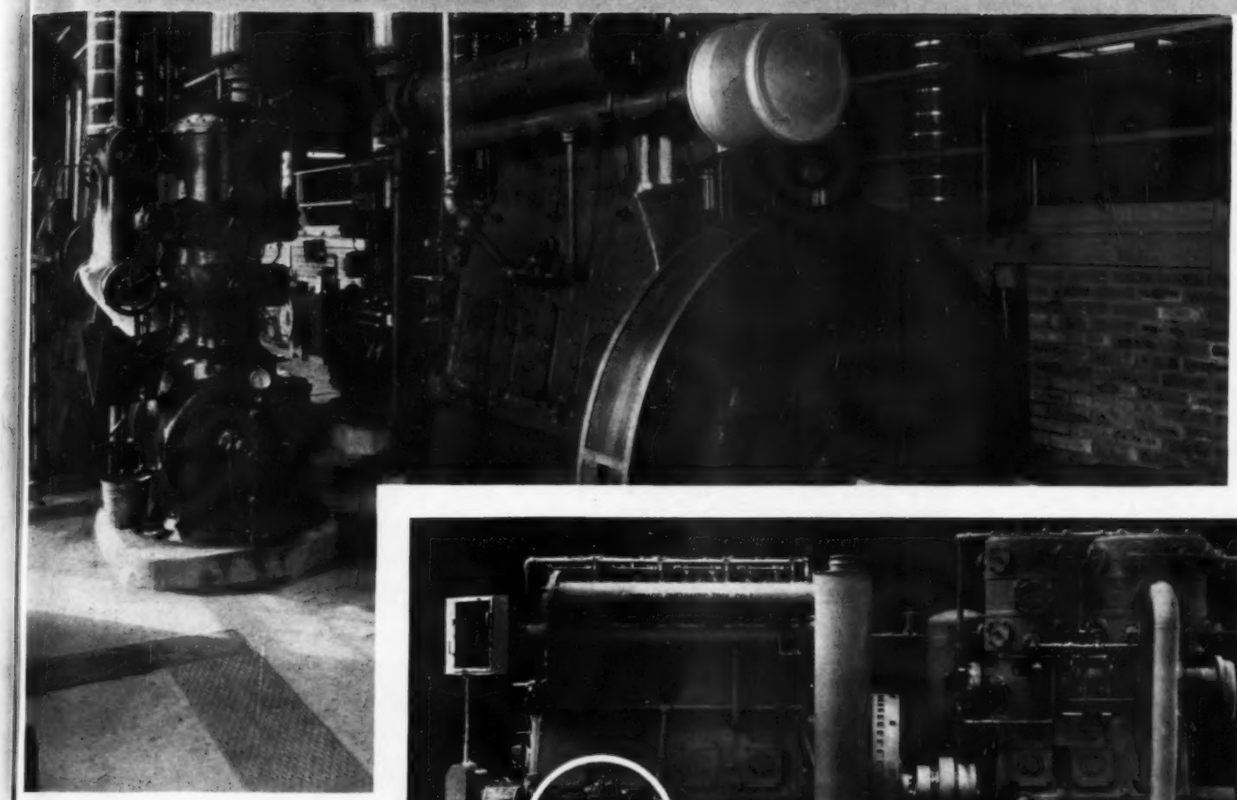
POWER GENERATION...
Before you decide on any power plant, see how much more F-M Diesels have to offer. For full information, write for Bulletin 81, Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.
FAIRBANKS-MORSE
Diesels
107 Years of Precision Manufacturing
Power, Pumping and Weighing Equipment

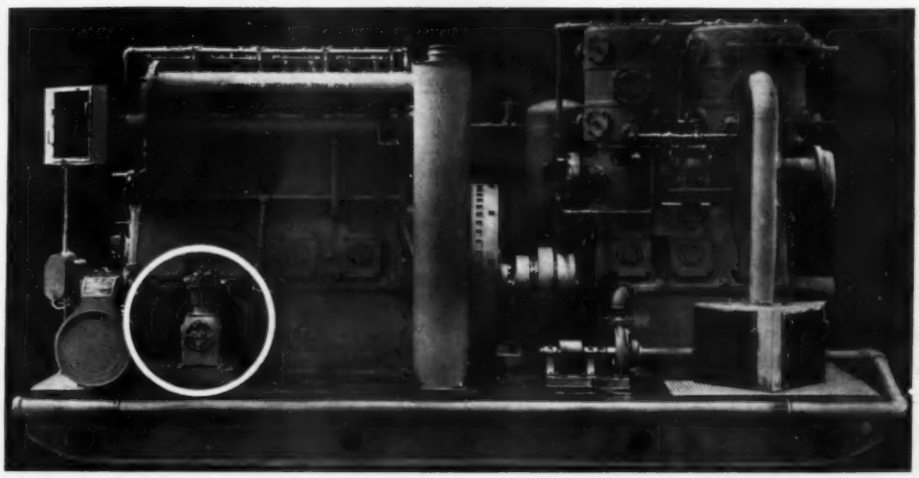
FOR DIESEL ENGINE STARTING



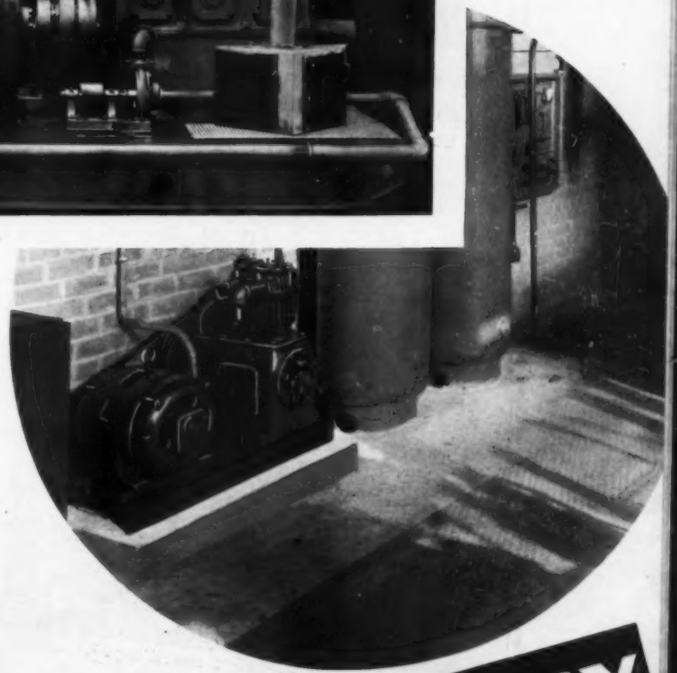
Left: Two 300 H.P. Chicago Pneumatic Tool Co. Diesels driving Frick Dual-Effect Ammonia Compressors in the Central Ice Co. plant, Brooklyn, New York.

Middle: Quincy Compressors are standard starting means on these Diesel driven, skid mounted, portable compressor sets made by the Chicago Pneumatic Tool Co.

Below: A Quincy Compressor provides unfailing starting power for the Central Ice Co.'s two Chicago Pneumatic Tool Co. Diesel engines.



HERE, TOO, QUINCY COMPRESSORS MEET EVERY REQUIREMENT



ALL THREE of these Chicago Pneumatic Tool Co. Diesel Engines are started by Quincy Compressors —a high tribute to the dependability, economy and lasting stamina of America's most highly favored means for starting Diesel engines. Modern in design, Quincy Compressors are "Tops" for starting Diesel engines—a fact amply supported by engineering data available on request.

QUINCY COMPRESSOR CO., QUINCY, ILLINOIS

WHERE AIR IS IMPORTANT

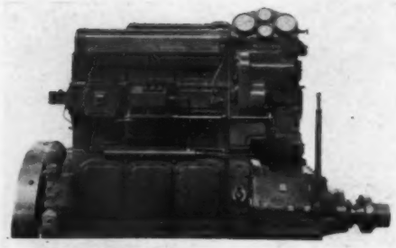
QUINCY Compressors

COOPER-BESSEMER EXHIBITS "TRANSPORTATION" DIESELS

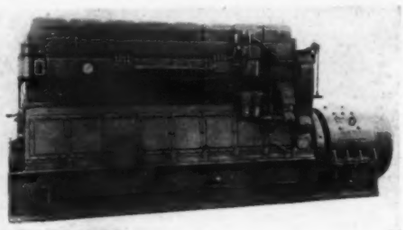
MODERN N-line Diesel engines that assure low-cost transportation on both water and land will be the keynote of the Cooper-Bessemer Corporation's exhibit at the Motor Boat Show in New York during January. The exhibit marks Cooper-Bessemer's 104th year as an engine builder.

Both types of engines on exhibit have been installed during the last year in marine and railway service – where they have proved unusually convenient, reliable, and economical.

For example, the Type GN-8 Diesel-electric set at the Show is an exact duplicate of the five units recently put into locomotive switching service by the New Haven Railroad. The rating is 660 hp. at 750 rpm. For marine service, the Type GN is built in 3, 4, 6 or 8 cylinders – the 6's and 8's being direct-reversing. Bore and stroke for marine service are 10½ x 13½". The rating ranges from 35 hp. per cylinder at 300 rpm. to 75 hp. per cylinder at 600 rpm.



The other engine on display, a Type EN-4 marine-gear Diesel, is particularly suited to the fishing industry. It is rated 110 hp. at 500 rpm. This 4-cylinder engine is built also as a 3, 6 or 8 for marine service – the 6's and 8's being direct-reversing. It is likewise available as a 6 or 8 for Diesel-electric switching service.



Bore and stroke are 8 x 10½". The rating ranges from 25 hp. per cylinder at 450 rpm. to 40 hp. per cylinder at 700 rpm.

Seven features of these N-line engines are standard: Diesel sturdiness in every piece and part; through-bolt construction carries all heavy stresses; cylinder liners suspended from cylinder heads; heavy-duty crankshaft, connecting rods, bearings; complete pressure or circulating lubrication to wearing parts; patented wrist-pin construction, for longer life; patented *atmospheric-relief* constant-pressure injection.

Recent marine installations of the Type GN and Type EN include: dredging, lighthouse tending, tugging, commercial fishing – on both the Atlantic and Pacific Coasts – and U.S. Coast Guard service. A number of GN-6 and GN-8 engines have been placed in railway switching service.

Among those in attendance at the New York Exhibit will be Messrs. B. B. Williams, T. F. Hudgins, C. M. Reagle, L. C. McEwen, C. G. Cooper, J. D. Cudney, Delbert Allen, S. E. Johnson and D. A. Robbins.

Vincent Astor's "Little Nourmahal"—2-110 HP Buda Diesels

Samuel Bell's "Sylvia III"—2-100 HP Superior Diesels

Wm. Beazley's "Vuel II"—2-100 HP Superior Diesels

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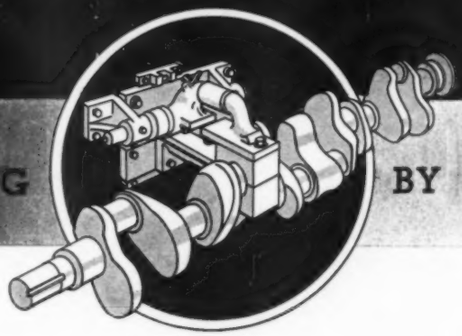
ADVANTAGES OF THE TOCCO PROCESS

SURFACE HARDENING BY INDUCTION



The TOCCO PROCESS of hardening steel parts substitutes almost instantaneous surface heating by electrical induction for the wasteful and time-consuming furnace-treating customary in carburizing, nitriding, cyaniding and other processes. With the TOCCO PROCESS it is literally true that *hours* of surface-hardening time are reduced to *seconds*. The TOCCO PROCESS is the *modern* method of selective surface-hardening. With it the hardened surface is kept within close limits both as to area and depth of penetration. Note the following important advantages:

● ***Longer Life*** TOCCO-hardened bearing surfaces (58 to 60 Rockwell "C" scale) wear from five to ten times as long as those produced by automotive heat-treating methods.

● ***Ductility*** Unusual ductility of the hardened area is evidenced by lack of flaking or spalling in service.

● ***Time Cycle*** Split-second heating cycle permits process to be included in the production machine line.

● ***Bond*** Cohesion between the hardened area and the core is unsually well diffused —as shown by photomicrographs.

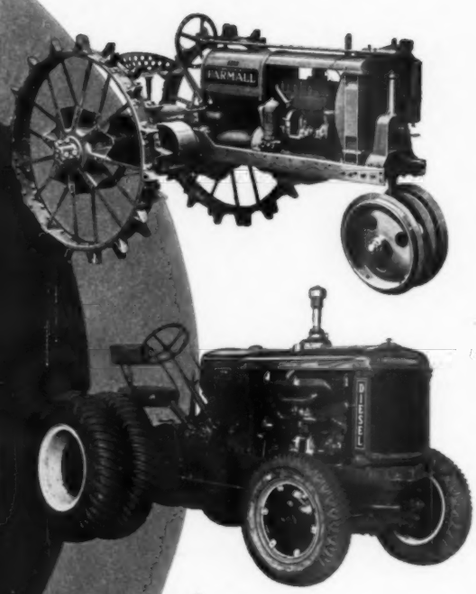
● ***Economy*** TOCCO-hardening permits use of a normalized crankshaft in place of a heat-treated crankshaft with consequent saving in heat-treating, machining, tool and straightening costs. Also permits the use of higher crankshaft speeds and bearing pressures than are customary with the heat-treated crankshaft. Hence horsepower per cubic inch of engine displacement can be increased.

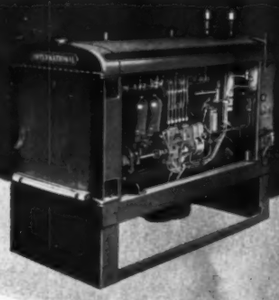
● ***Uniformity*** Absolute duplication of results is always assured.

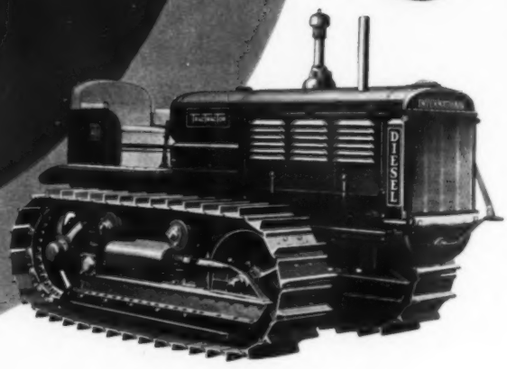
● ***Adaptability*** Localized heating may be controlled with ease, thus permitting the hardening of only the areas desired.

THE OHIO CRANKSHAFT CO. *Cleveland, Ohio*

INTERNATIONAL HARVESTER TRACTORS HAVE TOCCO-HARDENED CRANKSHAFTS







THE International Harvester Company has adopted TOCCO-hardened crankshafts for sixteen of its tractors and power units. This follows more than two years of testing TOCCO-hardened shafts in its tractors of various sizes and capacities. In the last 18 months thousands of TOCCO-hardened shafts have been used in their regular production. Complete equipment has been installed at the Harvester Company's Tractor Works to process crankshafts by this new and greatly improved method.

International Harvester is the largest builder of tractors in the world, producing 27 different models of tractors and power units. When it puts the TOCCO PROCESS of crankshaft-hardening into its own production line, it provides an endorsement which cannot be overlooked by other manufacturers of engines, tractors, trucks and all types of heavy-duty equipment. This has an important meaning to the *purchasers* and *operators* of all such equipment, too. It means lower operating costs and longer life for engines.

Other organizations with world-wide reputations for engineering leadership are using the TOCCO PROCESS, not only for hardening crankshafts but on cam shafts, axle shafts, front wheel spindles, steering gear Pitman arm shafts and other ferrous parts of cylindrical cross section. Among them are: the Autocar Company, the Cummins Engine Company, the General Motors Corporation, the Hercules Motors Corporation, the Packard Motor Car Company, the Waukesha Motor Company, the White Motor Company and many others both here and abroad. Write for the TOCCO booklet.

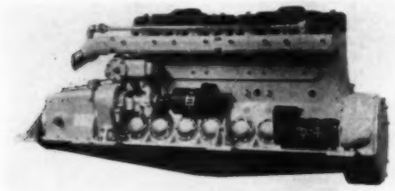
Are your engines equipped with TOCCO-hardened shafts? The next page explains why they should be. Read the reasons.

THE OHIO CRANKSHAFT CO.
CLEVELAND, OHIO

SUPERIOR DIESEL ENGINE EXHIBIT

A FEATURE of unusual interest will be found in the National Supply Company's exhibit of five Superior engines at the National Motor Boat Show this year.

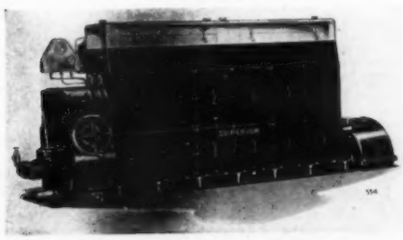
Here, through the medium of a beautifully finished cut-away model, the public will have an opportunity to get the "Inside Story" on this popular line of marine Diesels for the first time. Two definite impressions will be carried away by those who study this engine carefully — one, that nothing was overlooked that would make for rugged simplicity, and the other, that thoughtful consideration for accessibility and easy maintenance was given to every detail of design.



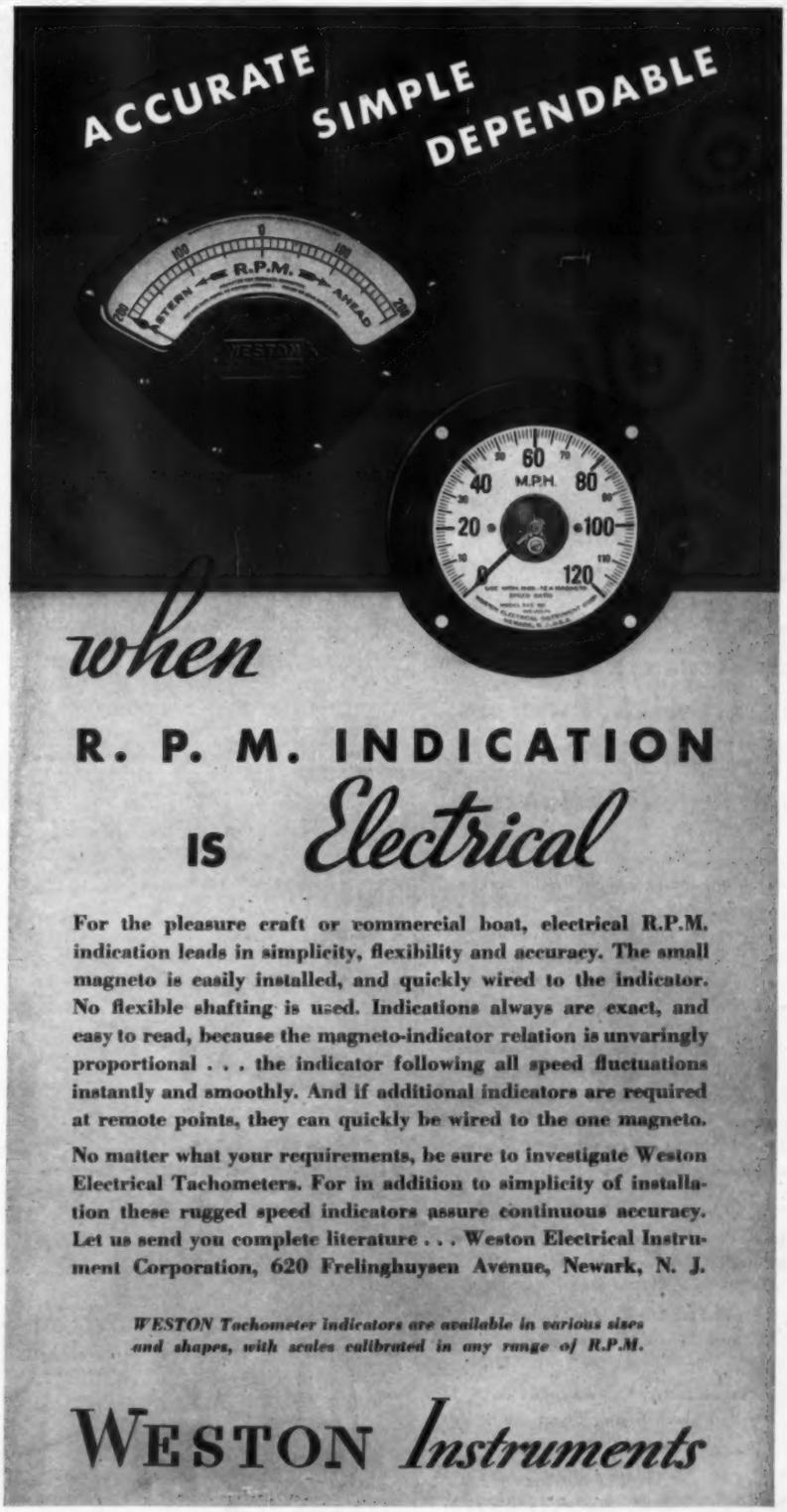
The total absence of oil pipes and fittings, the neat arrangement of accessories and the unique provision for raising the compression for cold starting, are other features of particular interest. All four models of this line of light weight engines have the same cylinder size (4½" x 5¾") and are identical in design.

The two cylinder engine, which develops 28 hp. at 1,400 rpm., will be shown as a 10 kw. D.C. marine type generator set. The four, developing 62 hp. at 1,500 rpm.; the six, 100 hp. at 1,600 rpm., and the straight eight, 150 hp. at 1,800 rpm., will all be shown as straight marine engines. With the exception of the two cylinder model, all of these engines are furnished in true rights and lefts for twin screw installations.

A fine example of the long line of heavier type, moderate speed engines built by this company will also be shown.



These engines are built in four different cylinder sizes with from 3 to 8 cylinders and range from 50 to 900 hp. All are similar in design and here again one gets an impression of simplicity and careful consideration for detail.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Sectional view of Burgess IRCF Series

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LICENSED UNDER C. F. BURGESS LABORATORIES, INC., PATENTS

THE SUPER-CHARGED DIESEL

. . . . *Continued from page 49* . . . .

gas turbine and the centrifugal blower driven by it, the pressure generated by the blower cannot very well exceed the exhaust-gas pressure acting upon the turbine. It was soon discovered that, in so far as exhaust-driven turbines are concerned, the knowledge gained in steam-turbine practice was of no value whatsoever. New lanes had to be charted; new methods had to be found. Soon the World War began, and research work ended for the time being.

After the late War, the U. S. Army Air Corps began experiments with supercharged aviation engines at McCook Field, Dayton, Ohio. Both gear-driven and exhaust-gas turbo-driven types were developed. A typical installation of an exhaust-turbine-driven supercharger upon an Army Pursuit plane is shown in Fig. 3.

The difficulties encountered arose from the fact that the back-pressure built up between the engine's cylinders and the turbine caused the exhaust valves to heat unduly. Since the object of the supercharger was to maintain sea-level rating of the engine at high altitudes, the waste-gate (see Fig. 4) had to be kept closed so that the full force of the exhaust gases could bear upon the turbine in order that the blower might be able to generate a pressure sufficient to be called supercharging. As said before, the back-pressure thus created caused overheating of the valves and, since the compressed air as delivered by the blower had to pass through the carburetor, no scavenging—i.e., freeing the combustion chambers of the engine from exhaust gas residue—was possible. Thus the experiments came to an end, and gear-driven blowers have become the standard of American aviation engines—and still are, for the time being at least. A schematic diagram of the U. S. Army Air Corps exhaust-turbine-driven supercharger is illustrated in Fig. 4. Clearly shown is the "waste gate" regulating the speed, resp. the pressure generated by the blower; the "inter-cooler" (placed in the slip-stream of the propeller) intended to cool the compressed air as delivered by the blower, is also shown.

Years later, the Büchi Syndicate and others, started with supercharger research work upon a new basis. It was realized that a pronounced pressure difference between the charging air and the exhaust gases is necessary and also, that the working cylinders should be effectively scavenged; i.e., freed from exhaust gas residue.†

The fluctuations in exhaust gas pressure existing in all manifolds or piping used to lead the gases into the open air are of an oscillatory nature; that is to say, the exhaust pressures rise and fall. They are strong (in the manifold) at the moment the exhaust valve has attained its full discharge, and very much less just before the exhaust valve closes again; i.e., when the spent gases have been discharged into turbine

†The exhaust gas residue within an engine's cylinder amounts to 8 per cent or more in an engine featuring natural aspiration. In non-scavenging supercharged engines it may run far higher than that.

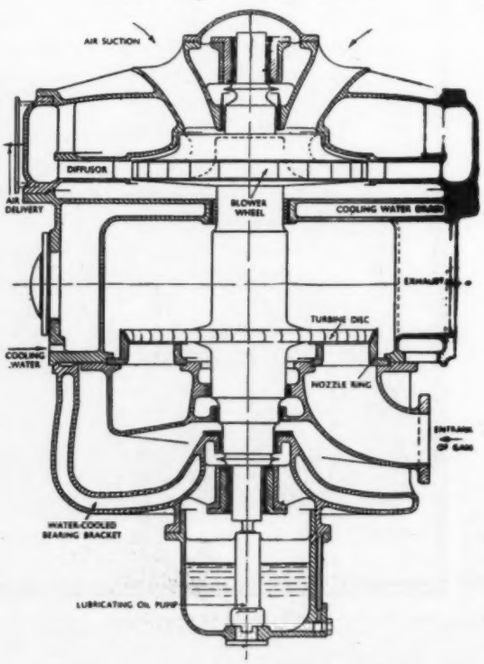

Fig. 8 — Buchi Syndicate type exhaust - gas - turbo - blower.

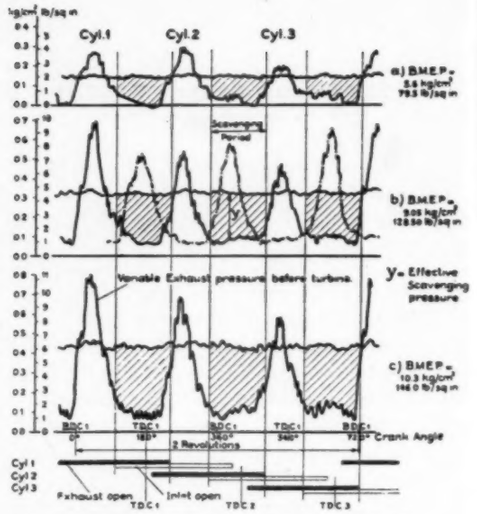

Fig. 5 — Pressure oscillations for various loads in two exhaust pipes of a 6-cylinder Diesel engine with exhaust-gas-turbo-charging.

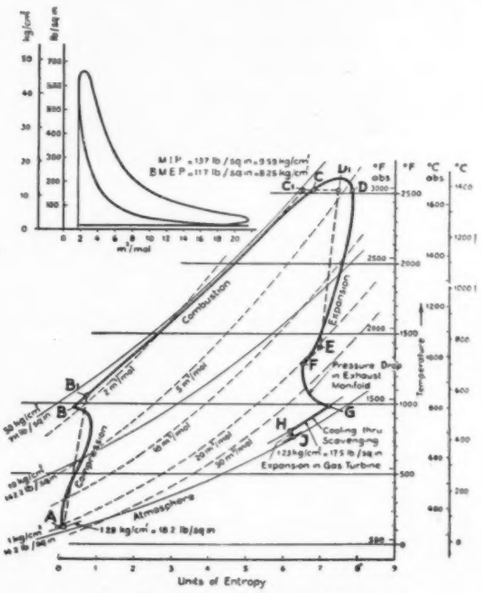

Fig. 6 — Entropy and indicator diagrams of a Diesel engine with exhaust-gas-turbo-charging.

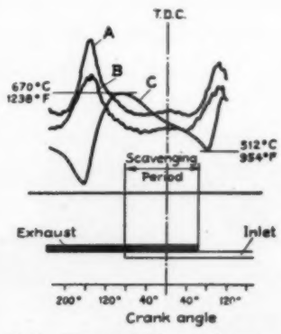

Fig. 7 — Temperature and pressure variations during the exhaust and scavenging period in the exhaust manifold between the engine and exhaust-gas turbine of a M.A.N. Diesel engine.

and from there into the atmosphere. These recurring oscillations in exhaust pressure are made use of to control to any desired degree the pressure drop required between the supercharging pressure and the exhaust-gas pressure ahead of the turbine. The pressure oscillations existing within the manifolds are depicted in Fig. 5.

The top curve of the chart (Fig. 5) shows the magnitude of pressure oscillations at part load, the lower curve at full load. The three cylinders exhausting into a common manifold have their discharges spaced 240° (crank angle degrees) apart, whereas the remaining three cylinders — while also firing 240° apart — have their exhaust periods occurring 120° later than the bank of the first three cylinders. This condition is made clear in the center curve of Fig. 5; the first set of three cylinders (indicated by a solid line) fire 240° apart, and the second set of three cylinders (indicated by dotted lines) also fires 240° apart, but so arranged that the

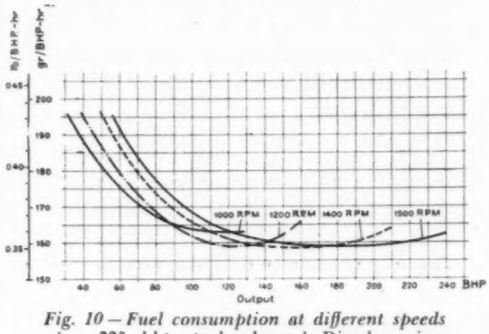

Fig. 10 — Fuel consumption at different speeds of a 225 bhp. turbo-charged Diesel engine.

exhaust is timed to occur between the intervals of the first set.

Thus the cylinders of a six-cylinder four-stroke cycle engine taken as a whole, exhaust in perfect sequence, 120° apart, as they should; since the exhaust of each cylinder of either bank is followed alternately, by the exhaust of one of the cylinders of the other bank.

The conditions of pressure, volume, and temperature of the working process with exhaust turbo-charging are shown by an entropy diagram — together with an indicator diagram — in Fig. 6.

The compression is shown as A-B, while the combustion is represented by B-C-D. D-F represents the expansion in the working cylinder. The exhaust valves open at F, the exhaust gases flowing to the turbine and at the same time expanding as indicated by F-G. The exhaust gases cool while on their way from the cylinders to the exhaust turbine, this cooling process being particularly aided by the scavenging air passing through the cylinders and mingling with the exhaust gas, which is shown as G-H. Just before the exhaust valve opens (point F), the gases (within the engine's cylinders) have a temperature of 1,282° F. Due to the pressure drop ahead of the turbine, corresponding to F-G, the temperature of the gases is reduced to 989° F. With an ercess of 27.4 per cent of scavenging air, the exhaust gases are cooled down to 815° F. from G to H; therefore the cooling resulting from the (air) scavenging amounts to 174° F., which includes a loss of heat of approximately 9° F. During the expansion of the exhaust gases within the turbine, the temperature drops from H to J, or down to 765° F.; hence the latter drop amounts to but 50° F.

When comparing modern scavenging-supercharging (Fig. 6) with the original mere supercharging of the vintage of 1911 (Fig. 1), the practical Diesel-man will notice the immense difference in the Entropy Diagrams, and also the blunt, well-rounded-out Indicator Diagram (Fig. 6) as compared to the ragged-pointed and wavering Indicator Diagram of Fig. 1. It is this marked difference in Entropy and Indicator Diagrams that tells vividly the whole story of modern scavenging supercharging.

The experiments the U. S. Army Air Corps conducted with exhaust-turbine-driven superchargers were not successful because no scavenging action could be provided for, since carburetted fuel (gasoline) was used. The back pressure bound to be built-up within the engine's cylinders when the exhaust gases are being held back cannot fail but heat-up the exhaust valves, not to speak of the additional amount of exhaust-gas residue that thus is forced to remain within the cylinders and there contaminate the incoming fresh gas-air charge. In modern scavenging-supercharged engines, the pressure of the exhaust gas is actually less at the valves than at the turbine entrance, and the drop in temperature during the scavenging period, is very marked indeed. In Fig. 7 are illustrated the temperature and pressure variations.

. . . . *And now please turn to page 62*

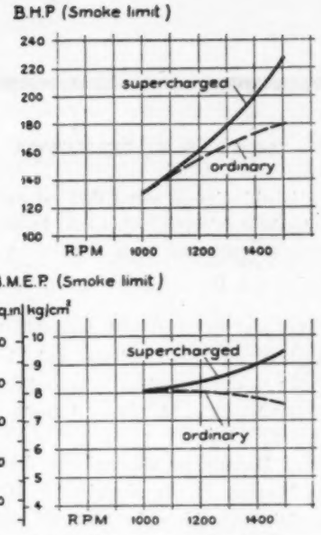

Fig. 9 — Variations of brake-horsepower and brake mean effective pressure at various speeds of a 225 bhp. 6-cylinder Saurer turbo-charged Diesel engine.

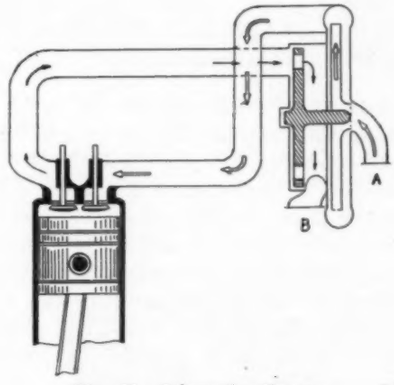

Fig. 11 — Schematic diagram of scavenging supercharging.

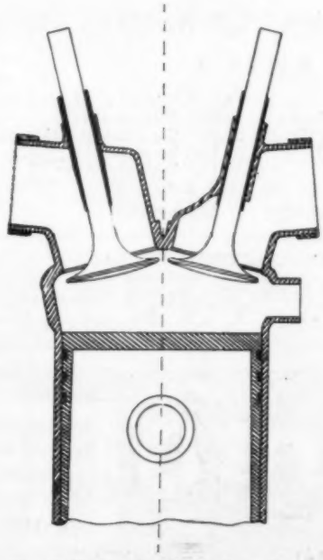

Fig. 12 — Cylinder head, both valves open.

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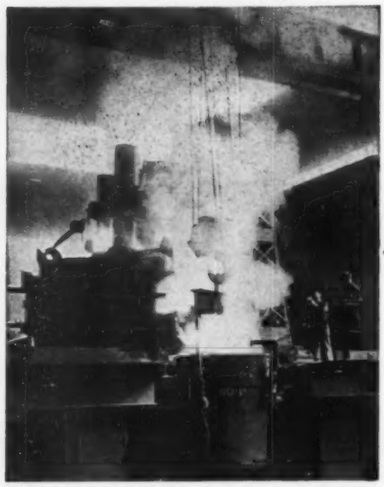

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WEAVER L. MARSTON

IT is with sincere regret that we announce the death of Weaver L. Marston in an automobile accident in West Chester, Pa., on Thanksgiving Day.

Mr. Marston was well and favorably known throughout the Diesel industry and his many friends join with the editor in extending heartfelt condolences to his bereaved family.

Weaver Marston at his untimely death was Sales Manager of the Sharples Specialty Co. and whilst only thirty-nine years old had built an enviable reputation for himself as an efficient executive and everything pointed toward a long and increasingly successful career.

He graduated in 1918 from the University of Pennsylvania with a degree in Electrical Engineering and whilst at the University was a leader in many graduate activities.

He joined the Sharples Specialty Co. in February, 1936, as Assistant Sales Manager, having previously been with the Liquid Carbonic Company in charge of sales in their upper New York territory. In 1928 because of the accidental death of the Sharples Specialty Company's Manager in California, Weaver was moved out there in the emergency and remained on the Coast until May 1, 1931, when he was brough back to Philadelphia and promoted to Sales Manager.

CENTRAL ICE COMPANY

. . . . *Continued from page 41* . . . .

in the ice tanks and to the ice storage room. The return gas enters the compressors through the lower or low pressure suction ports.

The gas from the low pressure lines is drawn into the cylinder through the valves in the piston in the normal manner for this type of compressor. The medium pressure gas enters through the ports which are uncovered by the piston at the bottom of its stroke. The piston is moving slowly and the gas fills the cylinder to the intermediate pressure. Thus the entire refrigerating load is carried at this medium suction pressure.

The dual pressure operation is controlled by the use of float valves and electric controls throughout the system, so that operation is nearly automatic and comparatively little extra attention is required from the engineer. In fact, with the dual compressor, the suction pressures are inherently balanced within the cylinder regardless of variations in the respective suction loads.

In the summer time the full capacity of the plant is utilized, and as much as 335 tons of ice have been turned out in one day. In the winter time the usual output runs around 150 to 200 tons. This means that the two Diesel driven units operate the year around, except that in the winter time it is sometimes possible to shut down one of them over a week end or when the demand for ice temporarily drops

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130 H.P. DeLaVergne (1)
110 H.P. Anderson (1)
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off. The motor driven units are operated in the summer as necessary to meet the demand. The whole setup provides great flexibility for meeting the demands for ice.

Air intake for the Diesel engines is from the engine room through Burgess filters on an extension of the air intake header on the engines. The exhaust is from the engine header straight up through the roof. There are two Burgess mufflers in series, one of them inside of the engine room and one on the roof because there is not sufficient vertical height inside for the second one.

Fuel is delivered to the plant by motor truck, and stored in a single 5000 gallon tank buried below ground just outside of the building where it can be easily filled. A transfer pump on the engine takes its suction directly from this tank and delivers through a filter to the engine injection pumps. Surplus fuel not wanted by the injection pumps is returned to the storage tank by gravity flow. Fuel used is number 4 Socony Vacuum.

Engine lubricating oil is Gulf Parvis H and compressor oil is Gulf Harmony C. Both the engines and compressors have their own individual pressure lubricating oil systems. In each case there is an engine or compressor driven circulating pump which takes its suction from the pump and delivers through a filter to the bearings. On the engines, there is an oil cooler. The practice is to draw off about 40 to 50 gallons of dirty lubricating oil from each engine about every 500 hours of operation and add fresh oil as may be necessary from time to time in order to maintain the oil level in the system at the proper point.

There are several safety devices. A high water temperature or low lubricating oil pressure on either engine sounds an electric alarm. A high ammonia compressor discharge pressure or a high engine exhaust temperature acts through a solenoid which shuts off the fuel supply and stops the engine.

Starting air at 450 lbs. pressure is stored in two tanks, and is supplied by a motor driven two stage Quincy air compressor.

One of the Diesel units has not stopped at this writing since it was placed in service on May 11, 1936. The other unit ran from May 11 to November 15 without stopping. It has since been shut down a few times voluntarily when the entire capacity of the two units was not needed, and there have been a few involuntary stops due to minor difficulties. Neither engine has been worked on since starting, but in January, as opportunity offers, the chief engineer plans to go over the engines and give them a thorough inspection preparatory for next season's run. Thus nothing in the way of maintenance records are yet available.

However, a few production cost figures have been accumulated. A little less than 3.5 gallons of fuel are required to produce a ton of ice. With fuel at about 5 cents per gallon and lubricating oil at about 40 cents, the operating cost of the Diesels is about 20 cents a ton. The corresponding figure for the motor driven compressors is 70 cents.

Even though the very highest type of reliability is demanded from the machinery in an installation of this character, no attempt is made to carry more than a modest supply of spare parts right at the plant. This practice is made possible by the service provided by the engine manufacturer, who maintains at the New York City branch a full stock of parts and four service men, all available 24 hours a day, any day, in an emergency. This branch is the service center for ten ice-making plants, containing a total of fourteen engine units, all installed during the past three years or so, and numerous industrial plants in New York City and nearby territory. Thus the equivalent of Edison breakdown service is provided.

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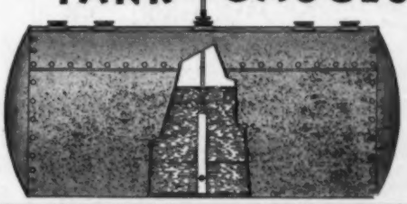
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THE SUPER-CHARGED DIESEL

. . . . *Continued from page 59* . . . .

The exhaust pressure at the turbine entrance is represented by the curve A, curve B represents the exhaust pressure just past the exhaust valve. It will be noted that the latter pressure is lower on account of the high velocity and kinetic energy of the gases. The temperature changes are represented by curve C; the very pronounced drop in temperature during the scavenging period is clearly indicated.

The performance of a scavenging-supercharged Diesel engine as against an engine of natural aspiration is depicted in Fig. 9 (dotted lines indicate natural aspiration).

The fuel consumption of a supercharged Diesel engine is shown in Fig. 10.

As will be seen, the fuel consumption at full power (225 hp.) is but 0.355 lb. per hph, and but slightly higher at overload, 240 hp.

The success of exhaust-gas turbo-blowers in their present development is primarily due to the fact that the scavenging action provides an open path, as is illustrated in Fig. 11.

White arrows show travel of compressed air (drawn from the atmosphere) from the blower to the inlet valve of the engine's cylinder. Black arrows show travel of air-exhaust-gas mixture from the combustion chamber to the turbine and its final discharge into the atmosphere.

As will be seen, the air drawn in by the blower from the atmosphere (at A) is compressed, and then delivered to the engine's cylinders, scavenging the latter and then leaving via the open exhaust valve while mingling with the exhaust gases; thence it enters the turbine and passes from the latter into the open atmosphere (at B). Thus the air makes one complete cycle, not being hampered or blocked anywhere, and returning — except for that portion remaining in the engine's cylinders as a charge — to the atmosphere from whence it was drawn. How different this process is from that shown in Fig. 4 — where the air is forced into cylinders, partly filled with dead exhaust gases — is manifest.

Mechanically, the exhaust-gas turbo-blower is far superior to the gear-driven type. When starting or at slow speeds, the former does not produce any appreciable pressure, and hence is not a load upon the engine nor does it hold back the free and easy discharge of the exhaust gases. In comparison, the latter is always a load, since the power consumed by a gear-driven blower is practically constant irrespective of whether or not compressed air is being delivered.

Referring again to Figs. 3 and 4, an exhaust-gas turbo-blower of modern construction would be particularly beneficial to aviation engines, and be a most effective means of compensating, up to highest altitudes, for the loss of power caused by the rarefied air at upper strata. Sad to say, there are no commercially built Diesel airplane engines in the United States! America — Quo vadis?

But even in present-day aviation engines using carburetted fuel (gasoline), exhaust-gas turbo-blowers could be employed by merely discarding the in many ways troublesome and dangerous carburetor and substituting fuel pumps instead. With the latter, the intake and exhaust valves of an engine may be open simultaneously (as shown in Fig. 12) since air only is used for scavenging. But that is a subject outside the scope of the present considerations.

While thus far only supercharging has been discussed, another matter of prime importance — i.e., piston and valve cooling by means of scavenger supercharging — will be fully dealt with in an article scheduled to appear in the February issue of DIESEL PROGRESS.

P.S. — *The illustrations Nos.* 1, 2, 5, 6, 7, 9, and 10, *are from a paper presented by* A. J. Büchi *at the Annual Meeting of* The American Society of Mechanical Engineers, *held in New York, November* 30th *to December* 4th, 1936. *The illustrations not otherwise credited, are the author's.*

PURSE SEINERS

. . . . *Continued from page 53* . . . .

them on Puget Sound, a few on the Columbia River and the rest in California. Another 100 boats of different types were turned out for the fishing industry. And over 100 new engines were put into older hulls.

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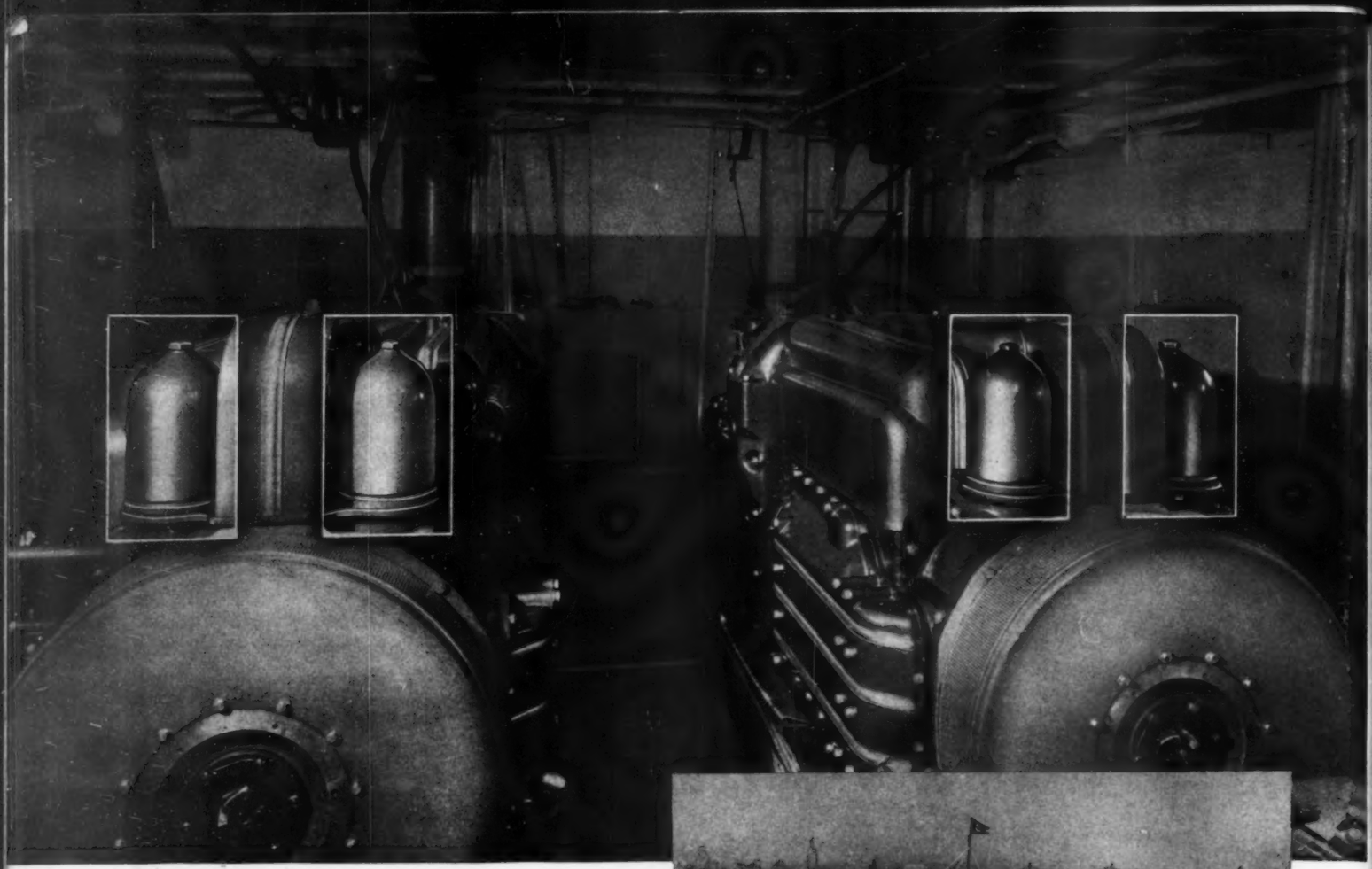

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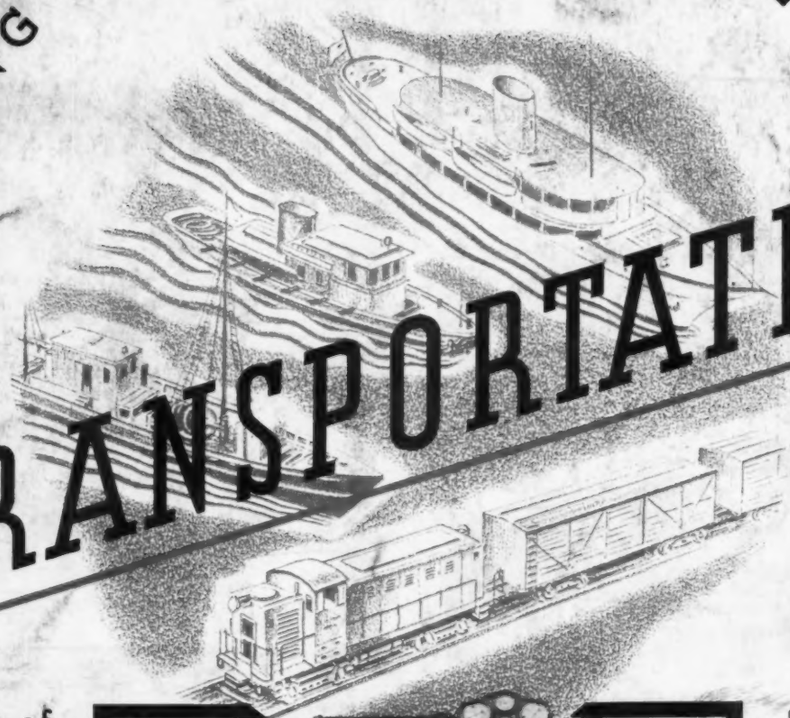

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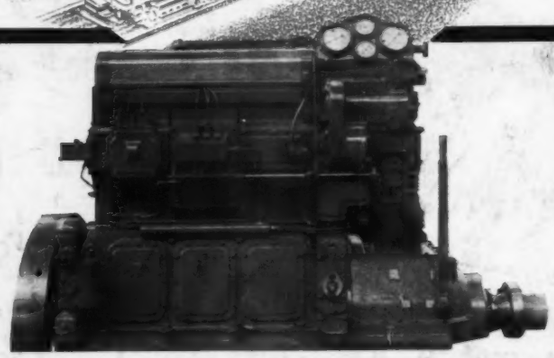

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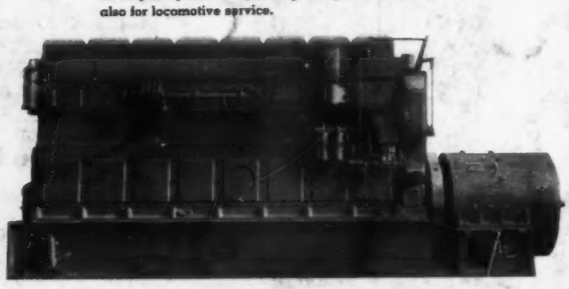

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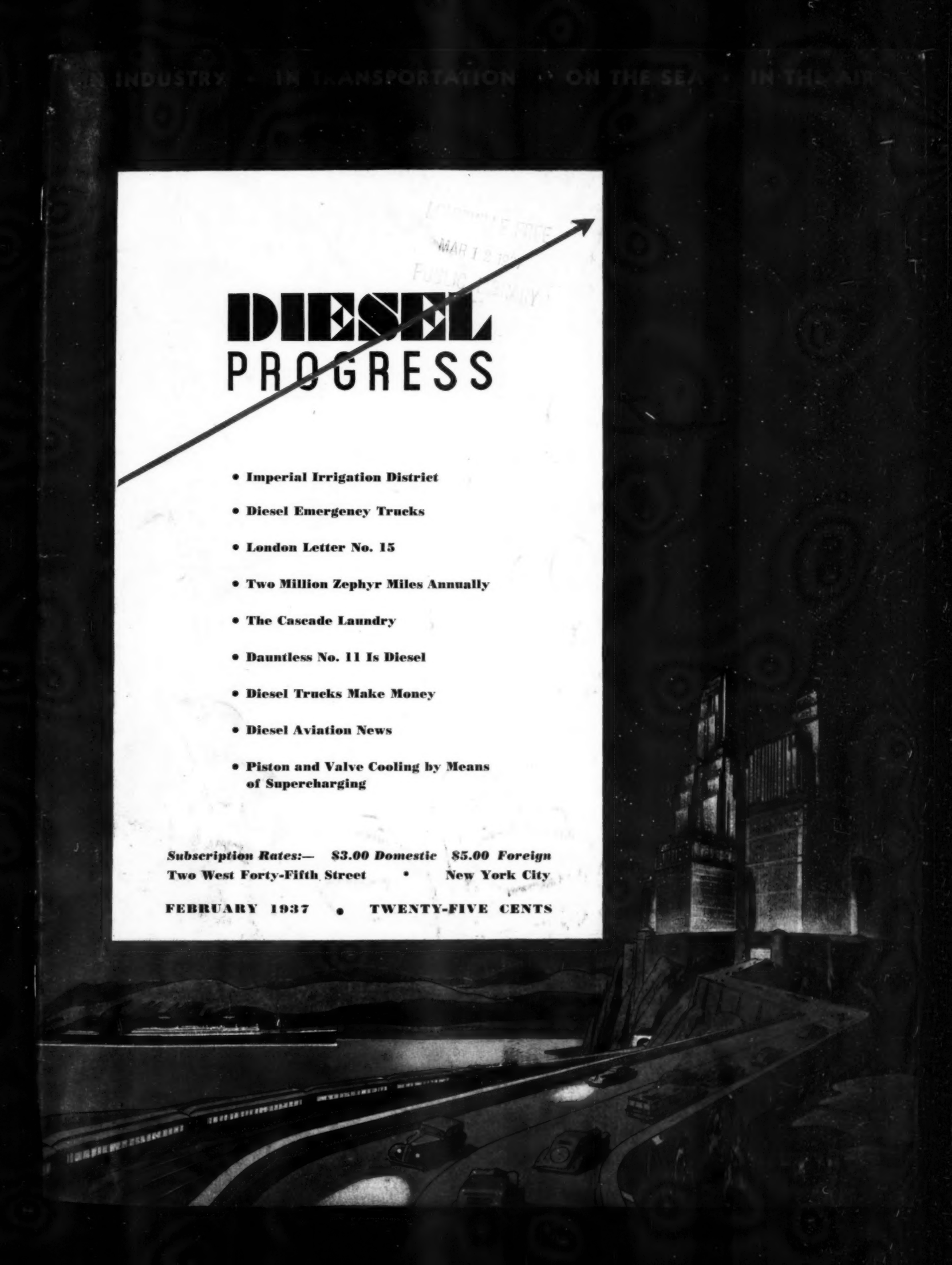

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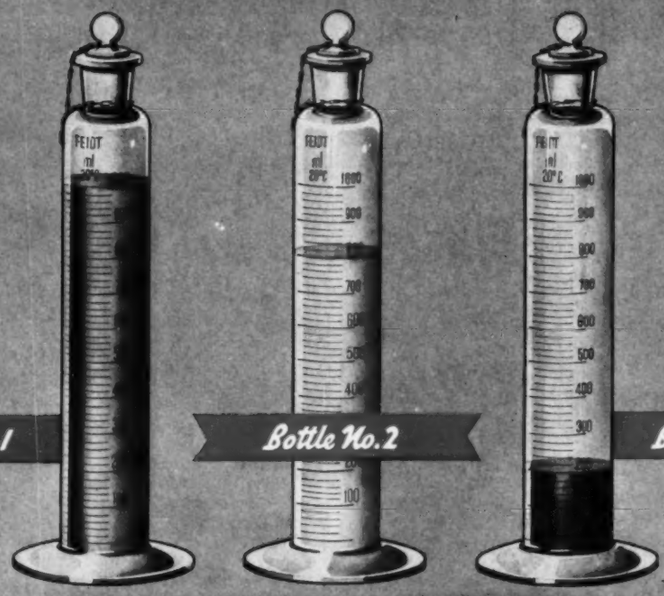

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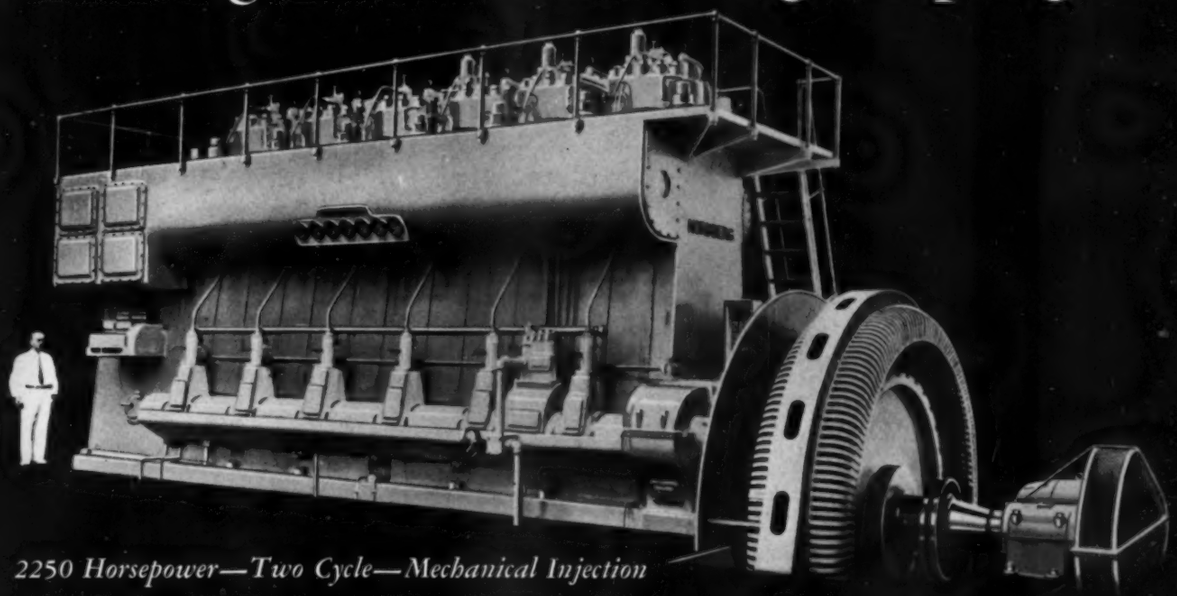

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By R. J. Hauchmann
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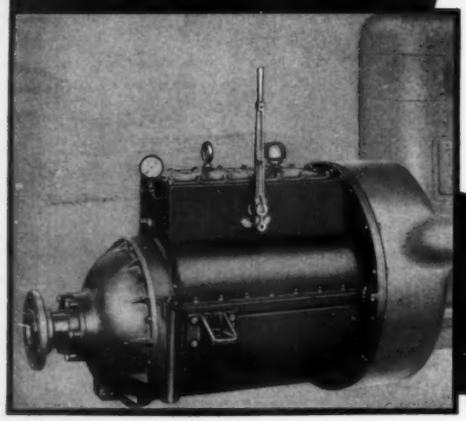

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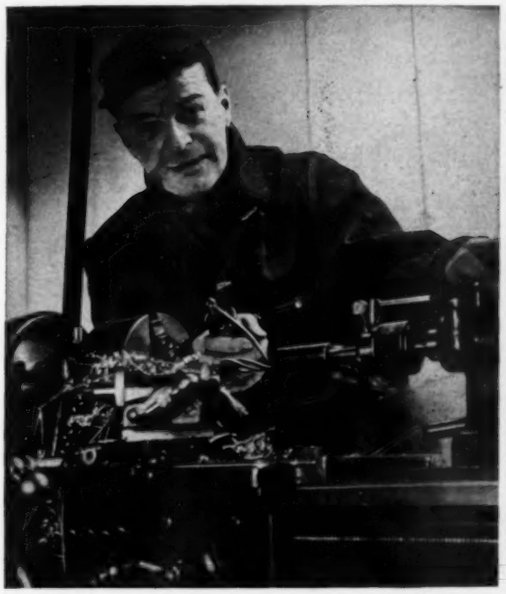
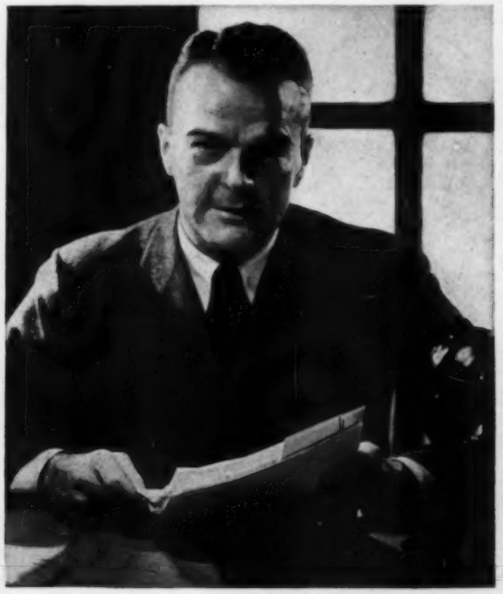
HE RAN A MACHINE INSTEAD OF A PLANT

Thousands of Socony-Vacuum's Business Friendships date back to the time when today's "Big Boss" ran a Machine. He asked for "Correct Lubrication" then... He insists on it today.





THIRTY AND FORTY YEARS AGO, men working at machines knew only one brand of lubricants for industrial machinery: Gargoyle Lubricants—made by the originators of "Correct Lubrication."

Today, many of these men who have "come up through the shop" to head America's biggest businesses still recognize this one name for Correct Lubrication... insist on Gargoyle Lubricants exclusively.

This great acceptance by plant men in 110 different industries is based on these four profitable efficiency factors: reduced power consumption, lessened maintenance expense, improved production, decreased annual lubrication costs.

It will pay every industrial executive to talk with the Socony-Vacuum representative when he calls... to urge plant staffs to find out how to put these benefits to work in your plant, increasing plant efficiencies and manufacturing profits.

SOCONY-VACUUM

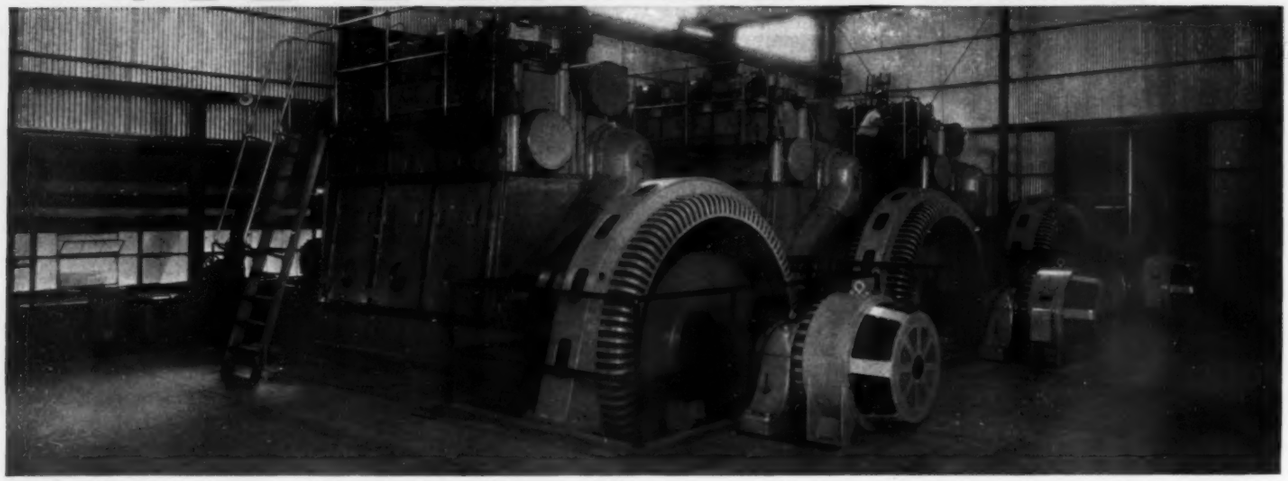
INDUSTRIAL LUBRICATION

GARGOYLE Lubricants

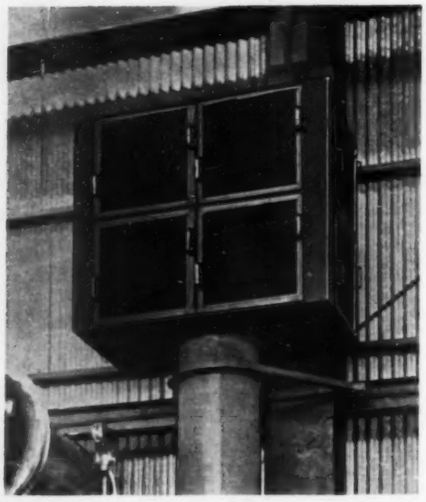
SAVES MONEY FOR INDUSTRY

71 Years' Lubricating Experience... the Greatest in the Oil Business

AAF PROTECTED



Another Outstanding Diesel Installation Protected With AMERICAN Air Filters



Close-up of one of the air intake filter units showing housing containing the eight American Air Filter cells which protect each engine.

PROTECTION of pistons, cylinders and bearings in these three Hamilton M. A. N. Diesel engines against excessive wear and air borne dust particles, is provided by a battery of eight American Viscous Filters installed on each of the engines.

Fourteen years experience in building filters for this need have resulted in the development of equipment to meet every air cleaning requirement. The interchangeable feature of the new American Air Filter enables either viscous, or dry felt type filter cells to be used in the same housing or frame to meet changing dust conditions should they occur.

Write for complete engineering data contained in bulletin No. 120B, which has just been issued.

AMERICAN AIR FILTER CO., INC.
INCORPORATED
280 CENTRAL AVENUE., LOUISVILLE, KY.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AMERICAN AIR FILTERS

MAHON CO.
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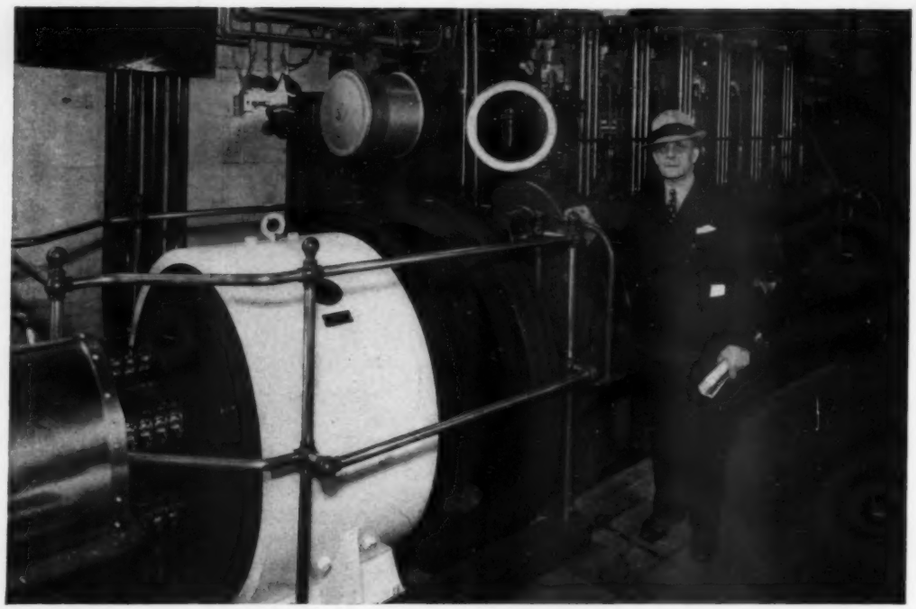
RAPID RIVER
MILLS
BUCKEYE
OK
BY THE TEST OF TIME
IN ALL KINDS OF
MOTORS
Millions of hours of actual lubrication in all makes of gasoline and diesel motors have proven the performance qualities of this remarkable motor oil. Out of this background of proven performance comes the Macmillan Man—bringing you not only records of lower operation costs, increased power and reduced friction but immediate proof of improved performance in your own equipment. Let him show you how the quality of motor oil can be quickly proved in any motor. Let him show you how you can not only save money but save your equipment from the ravages of undue wear and repair
MACMILLAN
RING-FREE
MOTOR OIL
1. GREATER FILM STRENGTH
2. HIGHER HEAT RESISTANCE
3. LONGER CLING TO METAL
4. FASTER PENETRATION
5. REMOVES HARD CARBON
6. IS NOT CORROSIVE

MACMILLAN PETROLEUM CORPORATION, 530 WEST 6TH ST., LOS ANGELES, CALIFORNIA OR EL DORADO, ARKANSAS

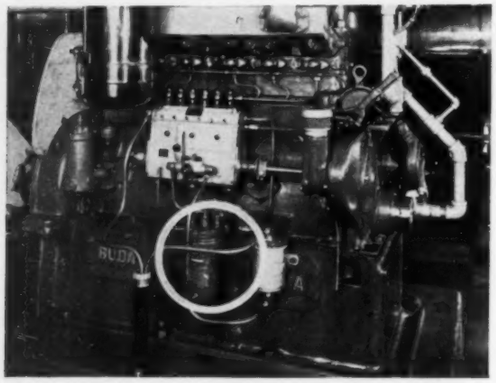
Let the Macmillan Man cut your maintenance costs on Truck Fleets . . Marine Engines . . Ice Plants . Tractors . Stationary Engines . Road Machinery . Hoists . Road Graders . Ditch Diggers . . any type of internal combustion motor whether it be of gasoline or diesel design

NUGENT Fuel Filters Protect Both Diesels at the Cascade Laundry

The above Oil Filter, Fig. 1116TH #45, is for fuel or lubricating oil for larger engines requiring a maximum of 36 gallons per minute. We manufacture fuel and lubricating oil filters having a maximum capacity of 232 gallons per minute.



Mr. Max Troy, Chief Engineer of the Cascade Laundry, with his new 300-hp., Chicago Pneumatic Diesel which he recently had installed. According to Mr. Troy, this unit will save his company $35.00 per day. A Nugent filter protects the Diesel from any impurities in the fuel oil.



The 35-kw. Buda Diesel generator set used for night service at Cascade is also protected by a Nugent fuel oil filter. Mr. Troy estimates the saving from this engine at $200.00 per month.

After many years of service this filter has proven the most efficient, economical and durable, replacing many other makes because they could not stand up under the heat and acidity in regular Diesel fuel oil. The Nugent Element having more area (Patented) is denser, gives cleaner oil with less frequent cleaning.

AFTER years of actual service under all conditions, Nugent filters have won recognition as the most effective and economical oil filters on the market. Wherever Diesels are used in the stationary, marine or transportation fields, Nugent pressure oil filters may be found contributing to their successful operation by insuring only clean fuel and lubricating oil reaching the engines.

WM. W. NUGENT & COMPANY, INC., have manufactured filters for forty years. The experience, research and development over this period are available in concrete form in every Nugent product at minimum cost to the user. Nugent pressure filters are positive insurance for your Diesel investment against grit, sludge and other impurities which might result in expensive damage. Leading Diesel manufacturers throughout the United States have accepted Nugent filters as standard equipment.

Lowest cost filter per square inch of filtering area on the market. (Patented)

Wm. W. Nugent & Co., Inc. Mfrs.
Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices,
Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.
417 N. Hermitage Ave. Established 1897 Chicago, U. S. A.

10 TIMES MORE Diesel service hours with SINCLAIR TEN-OL

1 *The finest grade of straight mineral oil was used to lubricate the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test. Note the evidence of excessive blow-by, the carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is excessive.*

2 *Sinclair Ten-ol lubricated the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test ten times as long as No. 1 on the left. Note the absence of ring-sticking, the perfect condition of oil control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.*

SINCLAIR TEN-OL, the new alloyed lubricant for "Caterpillar" Diesels, will mean a tremendous saving in your Diesel operation. In full power comparative laboratory tests, "Caterpillar" Diesel engines lubricated with Sinclair Ten-ol gave ten times as many service hours without shutdown as the finest straight mineral oils. In the average of all tests, consumption of Ten-ol was approximately one-half that of high grade straight mineral oils. In one of the tests a Diesel lubricated with Sinclair Ten-ol operated at extremely high overload with no damage to the engine and all lubricated surfaces kept in perfect condition.

Above are *unretouched* photos of pistons removed from "Caterpillar" Diesels after the tests. The piston to the left was lubricated by the finest grade of straight mineral oil. The piston on the right was lubricated by Sinclair Ten-ol in a test *ten times as long* as the one on the left. Look at the difference!

Order Sinclair Ten-ol, Sinclair Diesel fuel, and other Sinclair products from your local Sinclair office or write Sinclair Refining Company, 630 Fifth Avenue, New York, N. Y.

(Recommended as a "New Outstanding Diesel Engine Lubricant" by Caterpillar Tractor Co.)

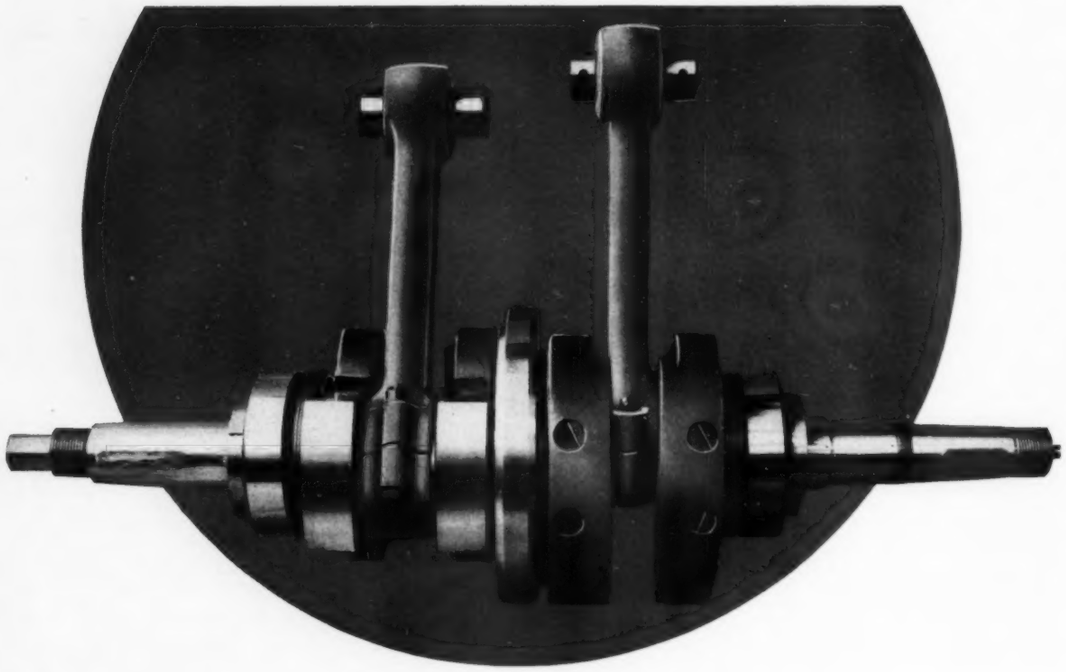
SINCLAIR TEN-OL

Copyrighted, 1937, by Sinclair Refining Company (Inc.)

SKF *Bearings*

Make Cold Weather Starting Easy

in Diesel Engines



THERE is considerably less effort required to start Diesel engines which are SKF-equipped. Take this SKF crankshaft and piston pin application, for instance. It not only makes starting easy in cold weather, but reduces maintenance and lubrication costs.

Low temperatures do not reduce the running efficiency of SKF Bearings as found in plain bearing applications. This and the ability to carry high unit pressures with minimum lubrication make SKF an ideal selection for crankshafts, piston pins and cross head. SKF self-aligning, self-contained spherical roller bearings on the crankshaft will compensate for slight but inherent misalignments and deflections, and do not require adjustments. Consult our district office for layouts and estimates on new designs, or write direct.

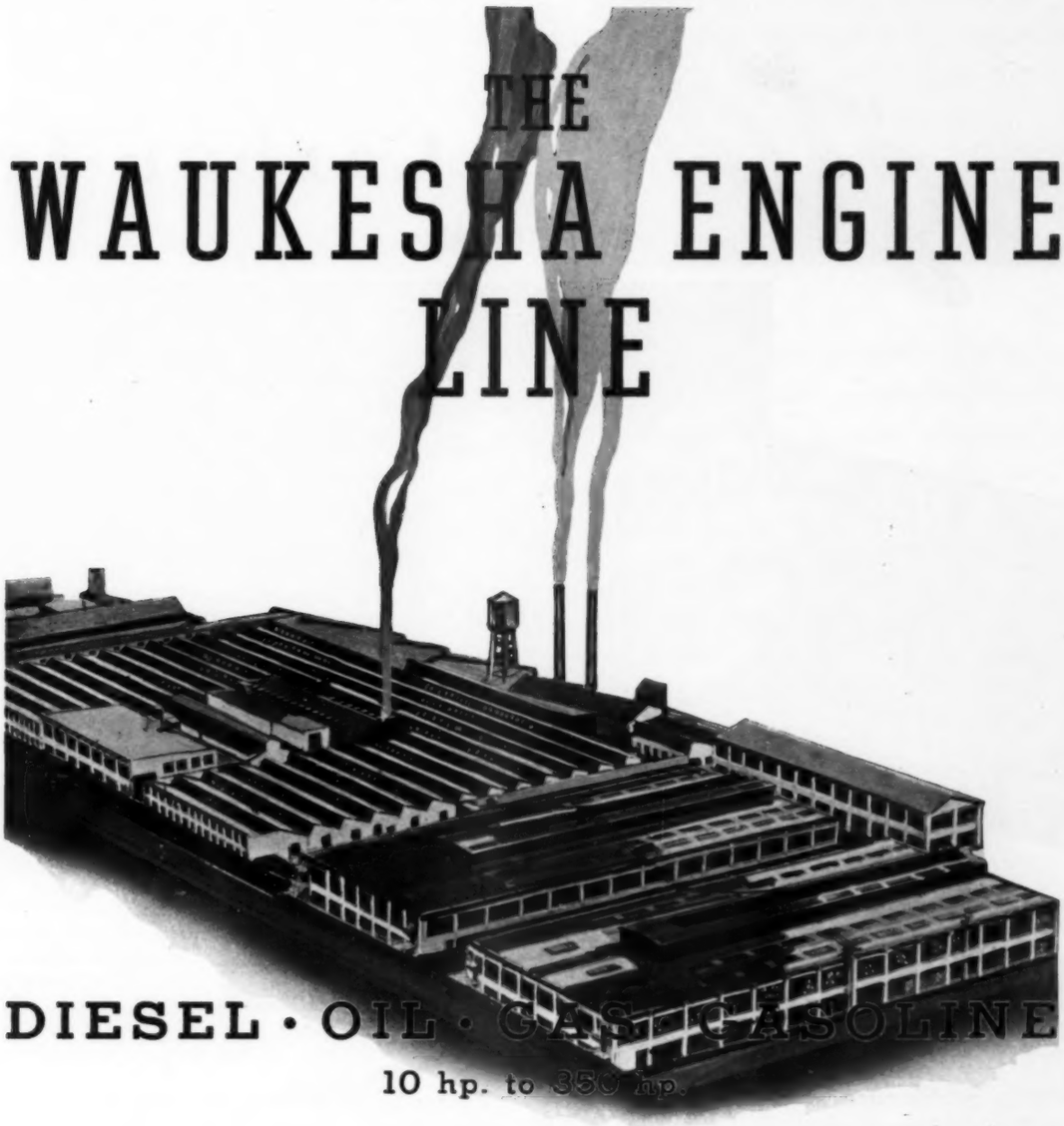
SKF INDUSTRIES, INC., Front St. & Erie Ave., Phila., Pa.

3786

SKF

Ball and Roller Bearings

THE WAUKESHA ENGINE LINE



DIESEL · OIL · GAS · GASOLINE

10 hp. to 350 hp.

INTERNAL COMBUSTION ENGINES FOR ALL HEAVY DUTY SERVICE

[Agricultural, Automotive, Industrial, Oil Field and Transport]

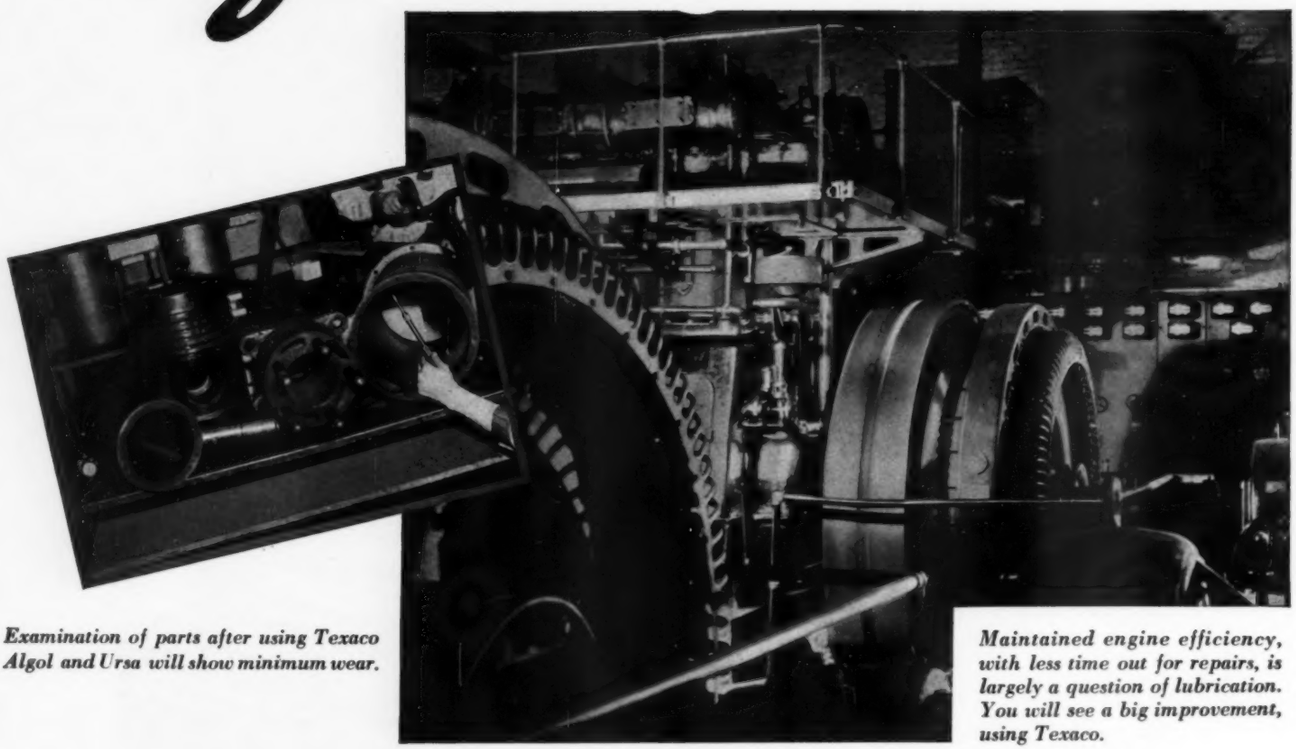
Write for Bulletin 827

WAUKESHA MOTOR COMPANY

WAUKESHA « « « » » » WISCONSIN

Eastern Sales Office: Eight W. 40th Street, New York City
Mid-Continent Office: 313 East 2nd Street, Tulsa, Oklahoma
Pacific Coast Office: 939 Santa Fe Ave., Los Angeles, Calif.

Valves, Rings, Ports *stay* Carbon-free



Examination of parts after using Texaco Algol and Ursa will show minimum wear.

Maintained engine efficiency, with less time out for repairs, is largely a question of lubrication. You will see a big improvement, using Texaco.

You can get the same carbon-free service from *your* Diesels that we get from *ours*.

In our Diesels, carbon doesn't form a matrix and build up . . . to wear cylinder liners, stick rings, clog ports.

In our Diesels, we use oils wholly distilled, then filtered . . . Texaco Algol and Ursa Oils. Any carbon formed is soft and fluffy . . . blows out of the system as fast as it is formed.

These Texaco Oils *keep* Diesels clean. Try Texaco Algol or Ursa Oils. *Then you'll know why, in this country, more Diesel h.p. is lubricated with Texaco than with any other brand.*

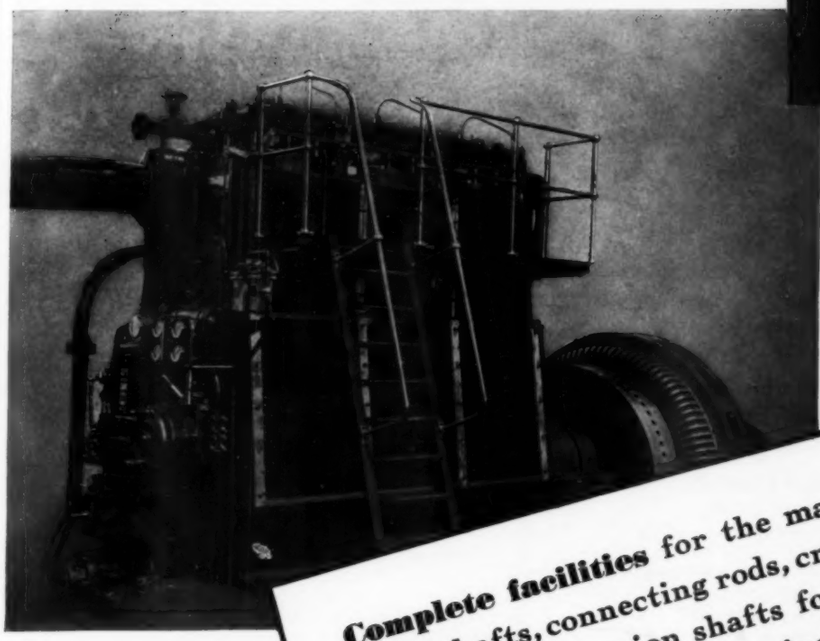
A Texaco representative will gladly provide practical engineering service, to prove the economies of Texaco Algol and Ursa Oils.

THE TEXAS COMPANY
135 East 42nd Street, New York City
Nation-wide distribution facilities assure prompt delivery

TEXACO

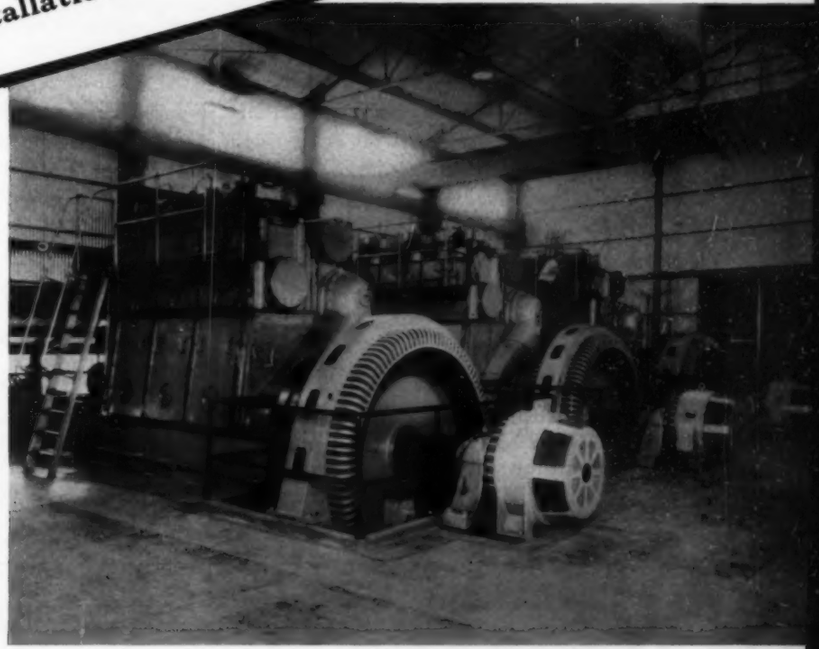
TEXACO *LUBRICANTS FOR ALL TYPES OF DIESELS*

ERIE crankshafts in operation in the three single acting, trunk piston, three cylinder Hamilton - M. A. N. Diesel engines installed by Hooven, Owens, Rentschler Co. for the Imperial Irrigation District of California at the Brawley Plant.



The fine quality and accuracy of ERIE crankshafts is again proven by the successful operation of these engines.

Complete facilities for the manufacture of crankshafts, connecting rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Prompt delivery on all major forged or cast steel elements required in the building and powering of every type of installation.



ERIE FORGE COMPANY

ERIE
PENNSYLVANIA

DIESEL APPLICATION PLAN BOOK

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Buy this book, you will find it more than worth while. It is edited by John W. Anderson, well known Diesel Engineer and author of the book "Diesel Engines." It is published by Rex W. Wadman, publisher of the monthly "DIESEL PROGRESS." This Application Plan Book is authoritative, informative, right up to the minute, a book you need; will you order one today—now—use the coupon.

DIESEL ENGINES, INC., Two West 45th Street, New York, N. Y.

I enclose $3.50, ship me postpaid one copy of DIESEL APPLICATION PLAN BOOK, it being understood I may return book (in good condition) within ten days of its receipt for full credit if I don't like it.

Name _____
(Please print)

Address _____

_____

LETTERS

Dear Mr. Wadman:

My Company mailed me copy of your DIESEL APPLICATION PLAN BOOK receiving it about ten days ago. I have gone over every page of same, and consider it very valuable in every way.

I have been looking for a book of this type for the past 20 years, that I have sold Diesel engines, just the other day I got out this book and the prospect and I went over many types of installations, I could not have gotten this man so much interested any other way I am sure. This book will be in my brief case daily from now on.

You have contributed to the Diesel industry a much needed instrument, and should be congratulated by all manufacturers and salesmen of Diesel engines.

M. D. CULP,
Buckeye Machine Co., St. Charles, Mo.

• • • •

Dear Mr. Wadman:

Our attention has just been called to your Diesel Application Plan Book 1936 by one of our local Diesel engine salesmen, and we note with interest the plan contained in this book, No. 179, which covers the application of Diesel engine in a four mill. We would appreciate it you would advise us at once who we can get in touch with to get more specific information concerning this installation and who you would recommend that we get in touch with who would be familiar enough with this job to be of assistance to us in our mill for similar installation.

Your prompt reply to the above request will be greatly appreciated.

R. L. ROBERTS,
Dallas, Texas.

• • • •

Dear Mr. Wadman:

To the host of bouquets which should now be flowing in from those who have received your PLANBOOK, may be add our congratulations to you for a beautiful job.

We like the concept — and the effective style in which the applications have been illustrated and described, the format, the modern binding — and everything.

Today's thinking embraces the Diesel engine, and we believe you have presented this modern product with 'commensurate modern feeling.

PAUL W. AUSTIN,
Owens, Illinois Glass Co., Toledo, O.

• • • •

Dear Mr. Wadman:

Your Plan Book has been received and I am greatly impressed with it. I am reading it in my spare moments at the present time and find it a splendid publication and one which I believe will stimulate much new business for the Diesel Engine manufacturers.

I know that such a book as this will be of great interest to our clients and I am going to utilize it in my sales efforts to illustrate the various types of Diesel Engine application to municipal and industrial power situations, so you see it has a very large workable possibility in furthering my own efforts to secure additional business for our own organization.

R. H. McDONNELL,
Burns & McDonnell Engineering Co.,
Kansas City, Mo.

10,000 BOARD FEET OF LUMBER IN EVERY LOAD

In the great forests of the Northwest the toughest, slowest job is snaking out the trees. But now, the Lamb SpeedTrakTruk, powered with a Model DHXB, 6-cylinder Hercules Diesel, brings out 90,000 pounds in one load at 8 to 10 miles per hour. Another instance in which industrial progress has been aided by Hercules engineering. Manufacturers of new equipment naturally turn to Hercules. For Hercules Engines, both Diesel and gasoline, enjoy an enviable reputation for dependability, smooth operation and long life. This reputation has been earned by the performance of Hercules power in every type of heavy-duty equipment. Over twenty years of experience in designing and producing heavy-duty engines exclusively lies back of every Hercules Diesel and gasoline engine available today.

Hercules Marine Diesel Engines supplied by Kermath Manufacturing Company, Detroit, Michigan

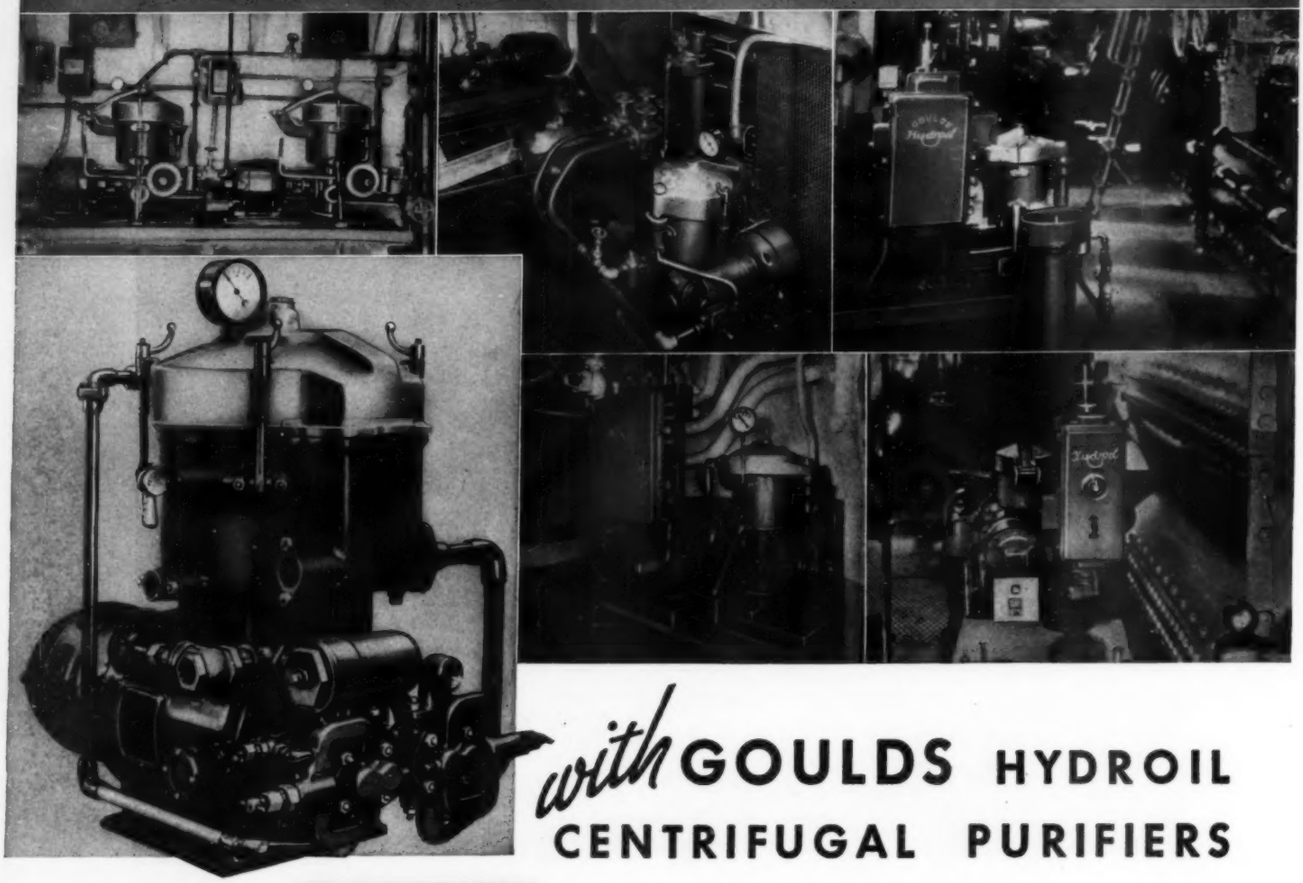
HERCULES MOTORS CORPORATION, CANTON, OHIO

America's Foremost Engine Manufacturer

HERCULES DIESEL ENGINES

Power Plants from 4 to 200 H. P.

PERFORMANCE ASSURED . . .



with GOULDS HYDROIL CENTRIFUGAL PURIFIERS

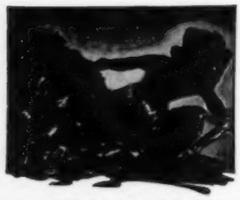
I was SLUDGE *the menace*

I was sharper than a "sea lawyer." I could turn smooth, clean oil into a slimy mess that played havoc with every bearing. But when they piped a Hydroil on board, I was sunk. It spun me around till I was nothing but a blob of dirt—then the oiler tossed me over the rail.

THE "'WHIZZER" PROVES HYDROILIZED OIL IS CLEAN

This unretouched photograph shows samples of used Diesel oil before (left) and after (right) purification in a Goulds Hydroil Centrifugal Purifier.

*A high speed laboratory centrifuge for testing oil samples.



Copyright 1937, Goulds Pumps, Inc.

SEA-GOING Diesels must not fail. Vessels tied up for engine adjustments or repair earn no income—yet costs go on. That is why leading operators protect their investment in Diesel engines with Goulds Hydroil Centrifugal Purifiers.

In the development of the modern Diesel manufacturers and refiners have worked side by side. As power increased and mechanical tolerances decreased refiners developed special oils to meet the more exacting demands created by higher bearing pressures and operating temperatures. But even these fine oils rapidly become contaminated in service and require frequent purification if their original lubricating value is to be maintained.

In the Goulds Hydroil dirt, water and abrasive carbon are removed from the oil—thrown out by a centrifugal force many thousand times greater than gravity. Elimination of contaminating material does away with plugged oil lines and prevents wear of bearings, cylinder walls, compressors and other parts. Hydroilized oil does not require frequent changing or rest periods—it can be used over and over. Fuel oil too can be materially improved by centrifugal purification. The removal of sand and water prevents plugged injector nozzles, reduces cylinder and fuel pump wear and materially increases ignition efficiency.

GOULDS PUMPS Inc.

SENECA FALLS, N.Y.

ATLANTA, BOSTON, CHICAGO, HOUSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, TULSA, Representatives in all Principal Cities

Superior DIESELS

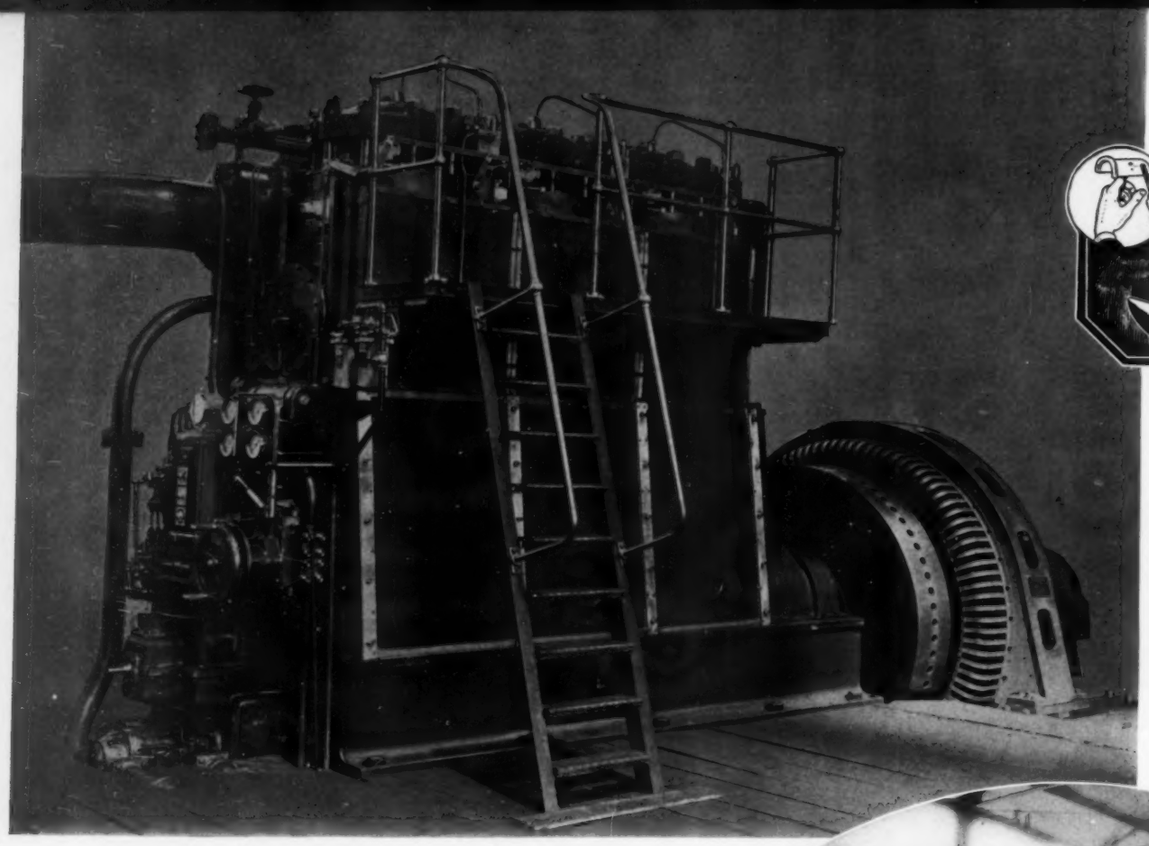
FOR POWER ECONOMY

The story of Superior Diesels is the story of power economy. It is the story of how power users in a field of diversified industries have won for themselves, through this modern Diesel, a new power independence and reduced their power costs to a level heretofore unobtainable.

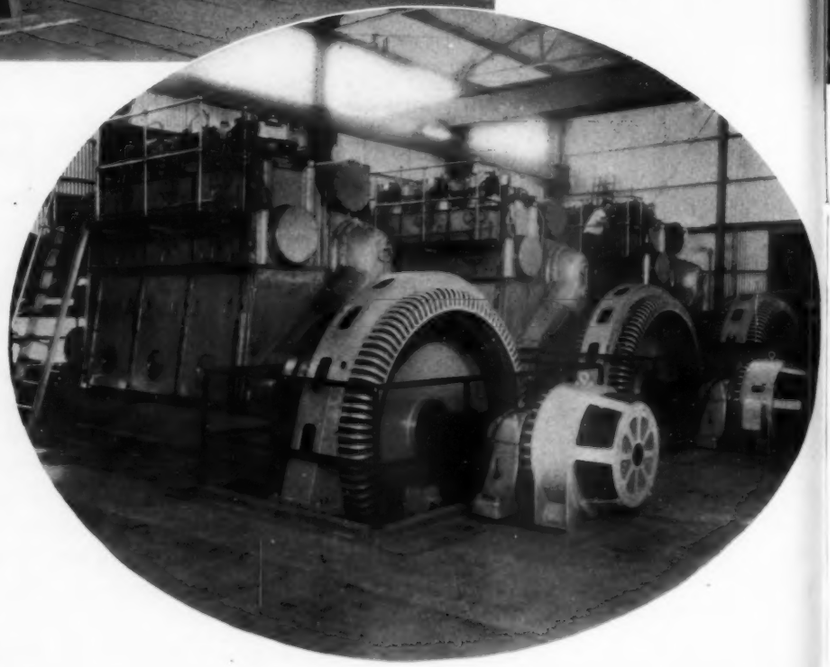
Superior Diesels meet every requirement of the modern plant . . . sturdy, compact, self-contained, reliable, clean, quiet and economical. The broad range of horsepowers—28 to 810—in two to eight cylinder models permits the small and the large power consumer alike to share in the economy of Diesel power.

The services of our engineering staff are available for a Superior Power Survey of your particular requirements without cost or obligation. Investigate the possibilities of modern Diesel power.

THE NATIONAL SUPPLY COMPANY
OF DELAWARE
SUPERIOR ENGINE DIVISION
Los Angeles, California Springfield, Ohio Philadelphia, Pennsylvania



A trio of HAMILTON-M.A.N. Diesel engines, built by HOOVEN, OWENS, RENTSCHLER COMPANY of Hamilton, Ohio. Each of these engines, 21⅛" x 27½", produces 750 kw. at 240 rpm. In the Brawley, California, plant of the Imperial Irrigation District. These Diesels have been in use for about six months and their Satco bearings have given the dependable service expected.



THE PROOF OF THE BEARING IS IN THE WEARING

WE'VE all seen boxers who are whirlwinds in the gym but who are just plain palookas in the prize ring. These fellows *promise* a great fight. But when the test comes they fade quickly. Now, take bearing metals—the gauge of their worth comes when the chips are down . . . in hard field service. No Diesel man wants a lining that leaves its fight in the factory. No Fancy Dans for him. He wants an alloy that gives more than it promises . . . that stands up day in and day out . . . that helps to turn out the kws economically and dependably. Satco* is that kind of bearing alloy. Want proof of its performance? Write!

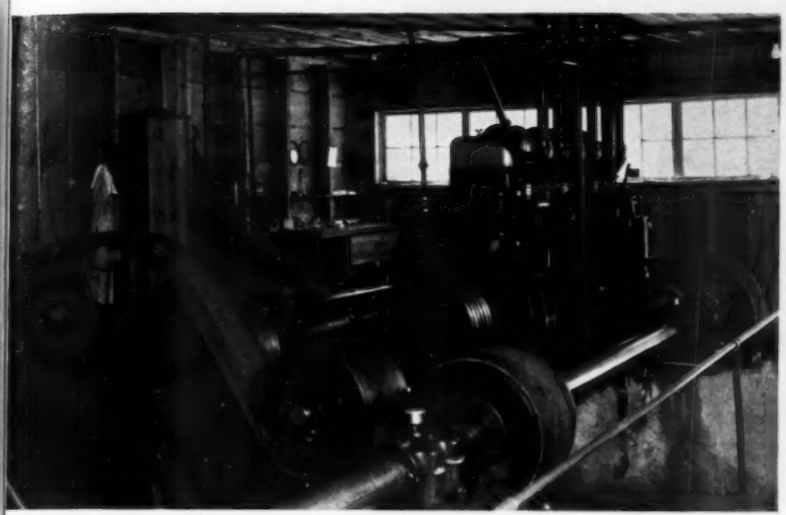
**A patented alloy manufactured by National Lead Company. Trade-mark registered.*

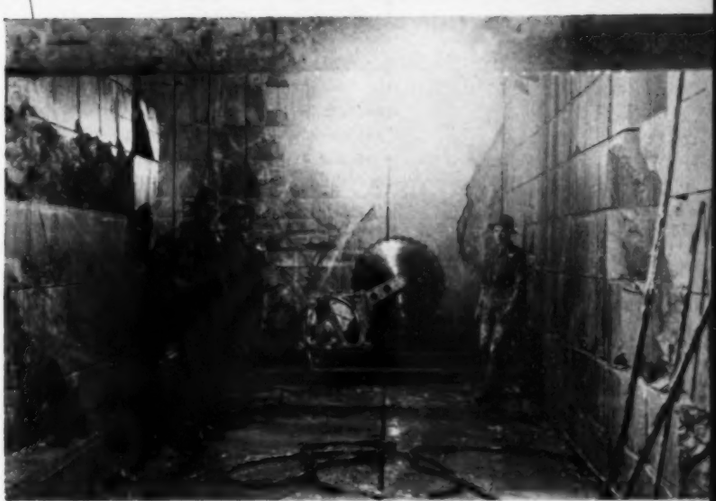
AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS CENTRIFUGAL American Bearings FORCE INDIANA

Atlas Diesels Power Skagit Talc Mine





THE SKAGIT TALC MINE at Sedro-Woolley, Washington, is another of those interesting enterprises in out-of-the-way locations, where Atlas Diesel power is utilized to make a variety of products available to the world.

Here they mine a wide range of talc and soapstone. A great portion of their production has gone to the Kraft paper mills of the country in the form of furnace lining blocks. The construction industry buys building facings and fireplace fronts from Skagit Talc, and their soapstone griddles make hot cakes to a queen's taste.

Commercial production was begun in 1933, with a wood-fired steam engine. In 1936 when they were ready to start capacity production, they installed a 135 hp. Atlas Diesel to operate the plant and mine equipment. This engine has reduced their power generating costs many times over compared to the steam engine, which is now used to saw mine timbers.

The Atlas Diesel is a 6-cylinder model and through Texropes it drives a line shaft from which are driven a 225 cu. ft. per minute air compressor, a 35 kw. Alternator and a 5 hp. generator. Compressed air is used to operate a coal cutter used in opening up new underground workings. The alternator operates the mine saw and the generator supplies lighting current. A second line shaft in the mill is belt-driven from the first shaft. Three mill saws are belted to it. The Atlas Diesel carries the entire load easily, smoothly, and economically.

ATLAS IMPERIAL DIESEL ENGINE COMPANY

OAKLAND, CALIFORNIA • MATTOON, ILLINOIS

ATLAS IMPERIAL

NO. 1 OF A SERIES

Is the Trade School "Educator" an outgrowth of the *Old-Time "Confidence Man"?*

QUOTE from Webster: *"rack'et*—A scheme, dodge, trick, or the like." Not found in Webster: *"rack'-et-eer*—A schemer, one who resorts to tricks, a promoter of rack'ets."—The old time "shell game artist," the "patent medicine" sales genius with his ballyhoo and covered wagon, the more modern promoters with their "oil stocks," "mine stocks" and other gilt edge schemes, —in short, the "get-rich-quick-Wallingfords" were racket'eers; and the schemes they promoted are known as "rack'ets."

With the turn of the century, industry and commerce in the United States started sprinting with a burst of speed never before dreamed of by man; and with it, methods of promotion, of advertising, of selling, spurted forward at as great, and frequently, at a greater pace.

With industry and commerce establishing new records of progress, another field of activity started to grow—the field of the privately operated trade and commercial schools. There was a definite need and place for these schools. Public education was chiefly academic and professional. There was a place in the trades and in business for properly trained, practical men; there was no adequate educational system established for enabling ambitious men to secure such training. The private school pioneered the way for providing this need.

Uncontrolled, free from regulation and law, private schools and private school methods—developed as did industrial and commercial methods—by the initiative of those individuals engaged in private school work.

What happened? If the individual or individuals were honest—their school was honestly operated; if they were good business men, their school was operated on a business-like basis. But here was the biggest of all problems —if the individuals were *educators,* if their background, their own education, their knowledge and experience in educational work was of the right kind, then their school was an educational institution. Unfortunately not all of the individuals operating private schools qualified under this most important classification: that of an *educator.* In those cases, because some of them were good business men, they may have produced profits; but schools must produce more than profits; they must produce well trained men who meet the requirements of industry or commerce.

What is the situation in the Diesel Industry today, as far as schools are concerned? Public schools still lag in providing adequate training in Diesel work. Private schools? In the last three years more than ninety different private schools have opened their doors to offer one kind of training or another in Diesel work, both home study and resident courses. This is a repetition of what has happened in the automotive, in the radio, in the electrical, and in numerous other fields. Is it not a fair statement to make—that many of these schools were opened and operated by other than the true *educator* type; and that such schools are being operated exclusively for profit? Is not this abuse of a legitimate, necessary activity the direct cause for many so-called school people to be known as "racketeers"—their schools as "rackets"?

National Schools

were established in Los Angeles in 1905—have continued without interruption under the management of its founders, with a definite policy of honesty, sincerity and worthiness of purpose. Today, National Schools, representing a million dollar investment, offer sound, thorough instruction courses in Diesel and Gas Engine work, Radio and Electricity.

•

Information regarding these courses or the Employer Service will be gladly given upon request.

NATIONAL SCHOOLS

4000 South Figueroa Street • Los Angeles, California

DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

GLOBE, ARIZONA, January 6th, 1937. The price of copper or rather the increase in the price of copper has created a new market for Diesel engines. Here in Arizona, and over in Nevada, copper mines and other metal mines, shut down for years, are opening up again – copper is going up, copper is selling high enough now to warrant the operation of many of these mines.

But they need power for operation, power right now. Their old high line connections have been discontinued, the poles are down, the wires broken. It will take time and lots of money to reinstate those high lines. So these mine owners are turning to Diesels and finding the ideal answer to their power problems. The Diesel engine can be promptly installed, it can be transported readily over bad roads to inaccessible places. The Diesel engine operates on a readily obtained, low-priced fuel and only burns a small quantity of that fuel. Furthermore, and this item frequently transcends all others, the Diesel engine requires but a small volume of water, especially if a closed cooling system be installed, for cooling purposes.

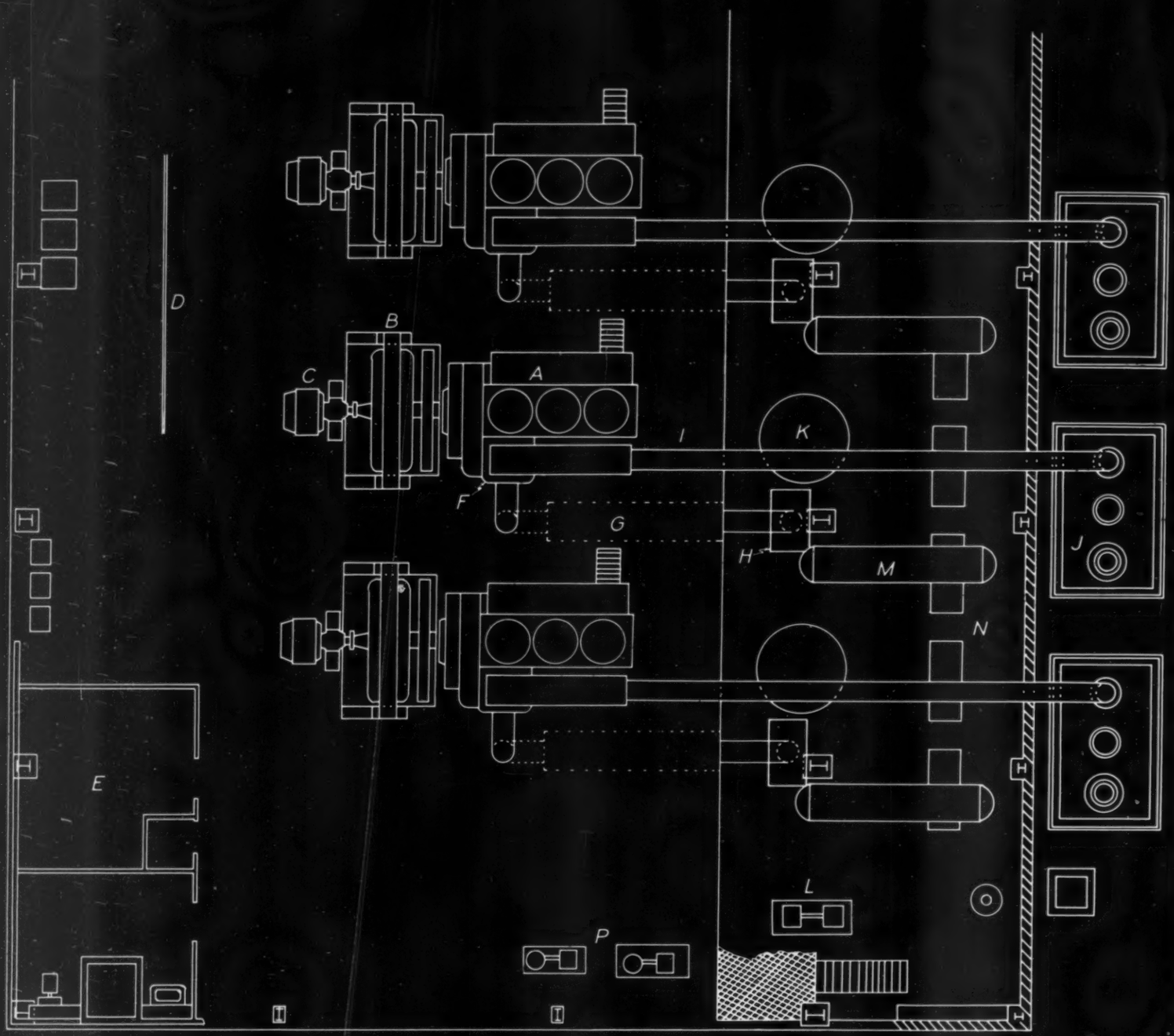
And so it is no wonder I have seen more Diesel salesmen in the past week than I thought there were in all seven of these Western states. And they're selling engines these hardy gentlemen who fear not rough roads, even horseback riding, down even to muleback riding, to reach some of these mine owners in the mountains of Arizona and Nevada. I have healthier respect than ever before for the Diesel salesman after following two or three of them through this territory. It takes intestinal fortitude to chase the elusive engine order out here.

And not all the orders are coming from the mines. The big water district which makes of Phoenix and its surrounding country a garden spot, is dickering for a 7,000 hp. Diesel unit. Dozens of Diesels are being installed in this state for ice plants, pumping, irrigation, power generation, etc. Arizona is a great State for the Diesel salesman.

Rex W. Wadman

FRONT COVER ILLUSTRATION used through the courtesy of the Hotel New Yorker and other hotels under the management of Ralph Hitz.

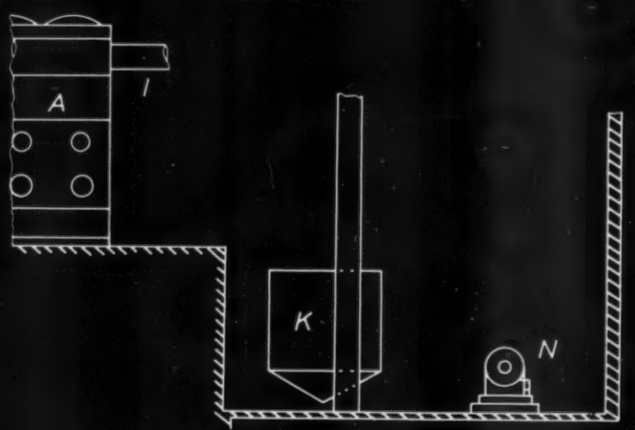
Subscription rates: U.S.A. and Possessions – $3.00 per year; all other countries $5.00. DIESEL PROGRESS, 2 West 45th St., New York, N. Y.



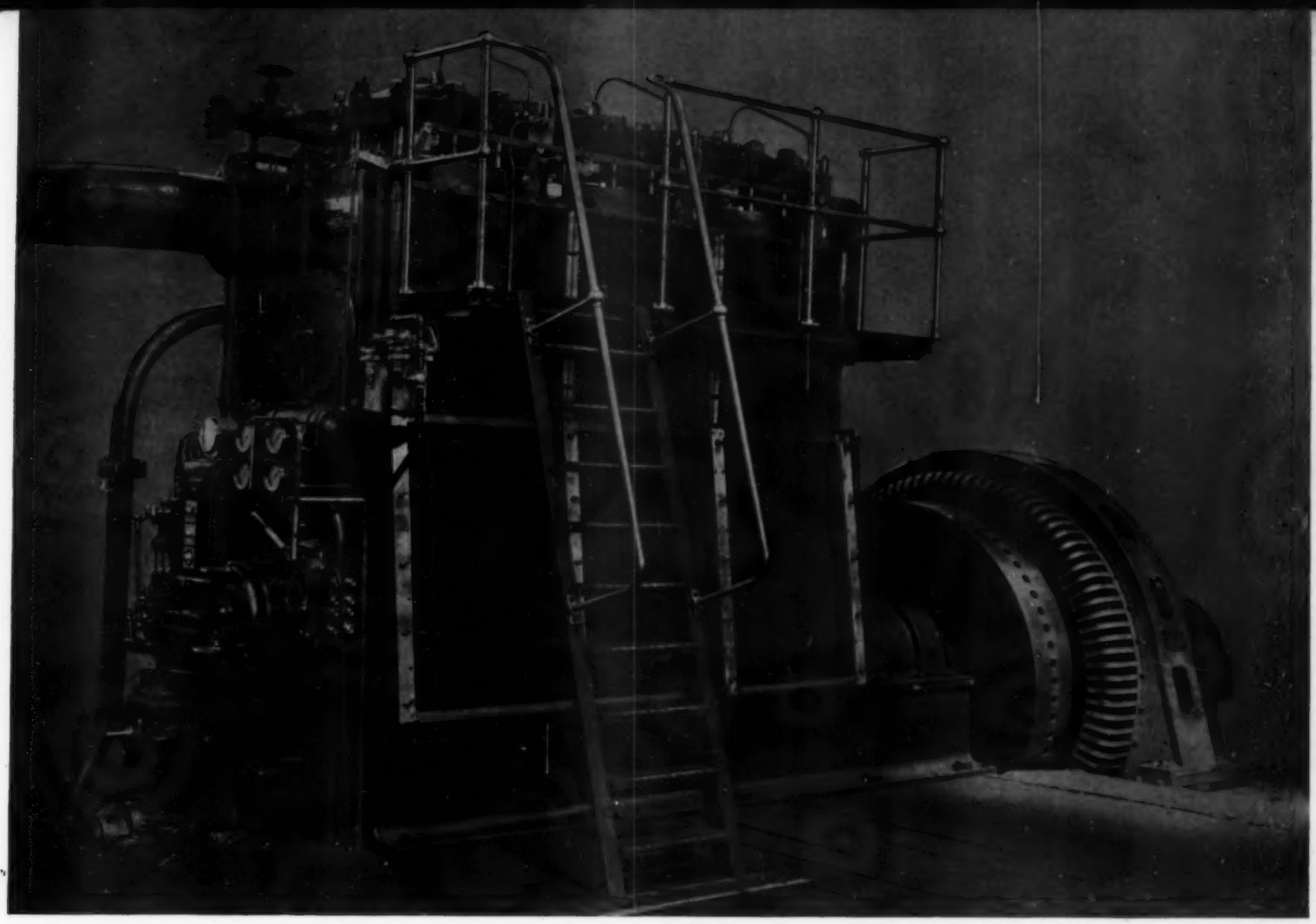
PLAN

LEGEND

A Three cylinder two-cycle 1125 hp 240 rpm Diesel engine
B 750 kw 60 cycle 4000 volt alternator
C Exciter
D Switchboard
E Office
F Scavenging air pump driven by engine
G Air intake muffler under the engine room floor
H Air intake filter attached to columns
I Exhaust pipe
J Exhaust muffler
K 900 gallon lubricating oil service tank
L Motor driven standby lubricating oil service pump
M Cooling water heat exchanger
N Motor driven cooling water pumps
O Starting air storage
P Starting air compressors



SECTION



Hamilton-M.A.N. Three Cylinder 1,125 hp. Brawley engine before shipment.

IMPERIAL IRRIGATION DISTRICT

By H. M. PETERSEN, C.E.

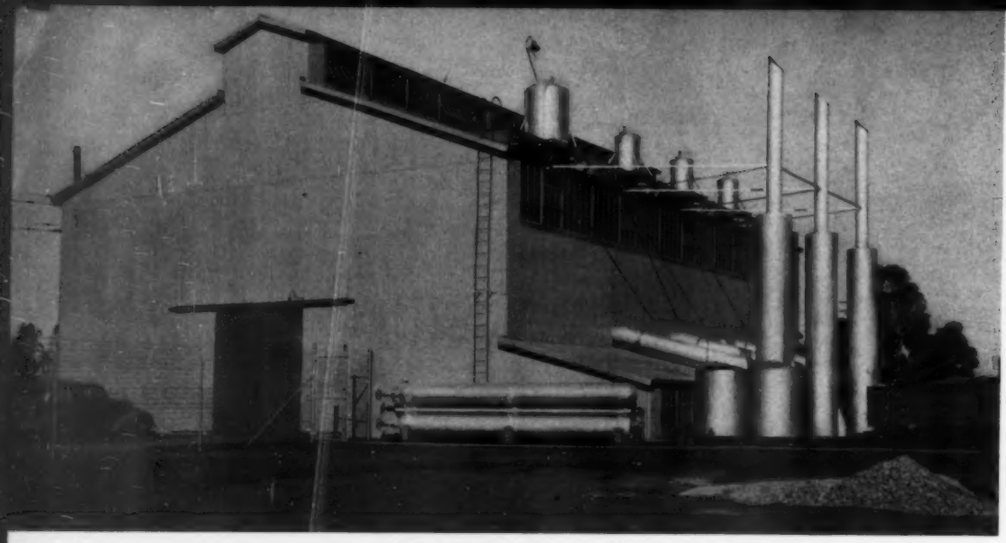
DOWN in the heart of the Imperial Valley, close to the Mexican border in Southern California, is one of the most interesting Diesel plants in this country. At the moment it consists of three single-acting, trunk piston, two-cycle, three-cylinder, 21½" x 27½" Hamilton-M.A.N. Diesel engines rated at 1,125 hp. at 240 rpm.

There is an interesting history back of this installation which really must be told before the reasons for installing this Diesel plant become evident.

The Imperial Valley itself is hemmed in by mountains and desert. It is below sea level and is absolutely dependent on irrigation for its existence. Irrigation started in the Valley about 1900. In 1905 the Colorado River broke through its banks and the Canal on which the Valley depended for its water went through its banks in the section of it which passes through Mexico. Naturally much damage was caused. From that date on, over thirty years ago, agitation began to bring the control of the water used for irrigation in the Imperial Valley all within the continental limits of the United States of America. This agitation came to a head when the Boulder Dam became a reality and the All American Canal was tied into and became a part of the Colorado River control.

The All American Canal is now well under construction, and by referring to the map on the next page, it will be seen that this new Canal leaves the Colorado River close to Yuma, Arizona, and works its way down into the Imperial Valley on the American side of the border, so that the life-giving water so necessary for the Valley's existence will, when the All American Canal is completed, be entirely under U.S.A. control.

The All American Canal will carry water in 1938 and the Imperial Irrigation District is under contract with the government to pay the cost of this Canal in forty years. To make this repayment possible, five power drops will be installed along the Canal, as are indicated on the map, and hydro-electric equipment installed to generate power for distribution in the Valley. In working out these plans it was necessary, of course, to provide for a standby plant and decision was made to make this a Diesel standby plant, to take over the load if one or more of the hydro-electric units should be shut down temporarily.



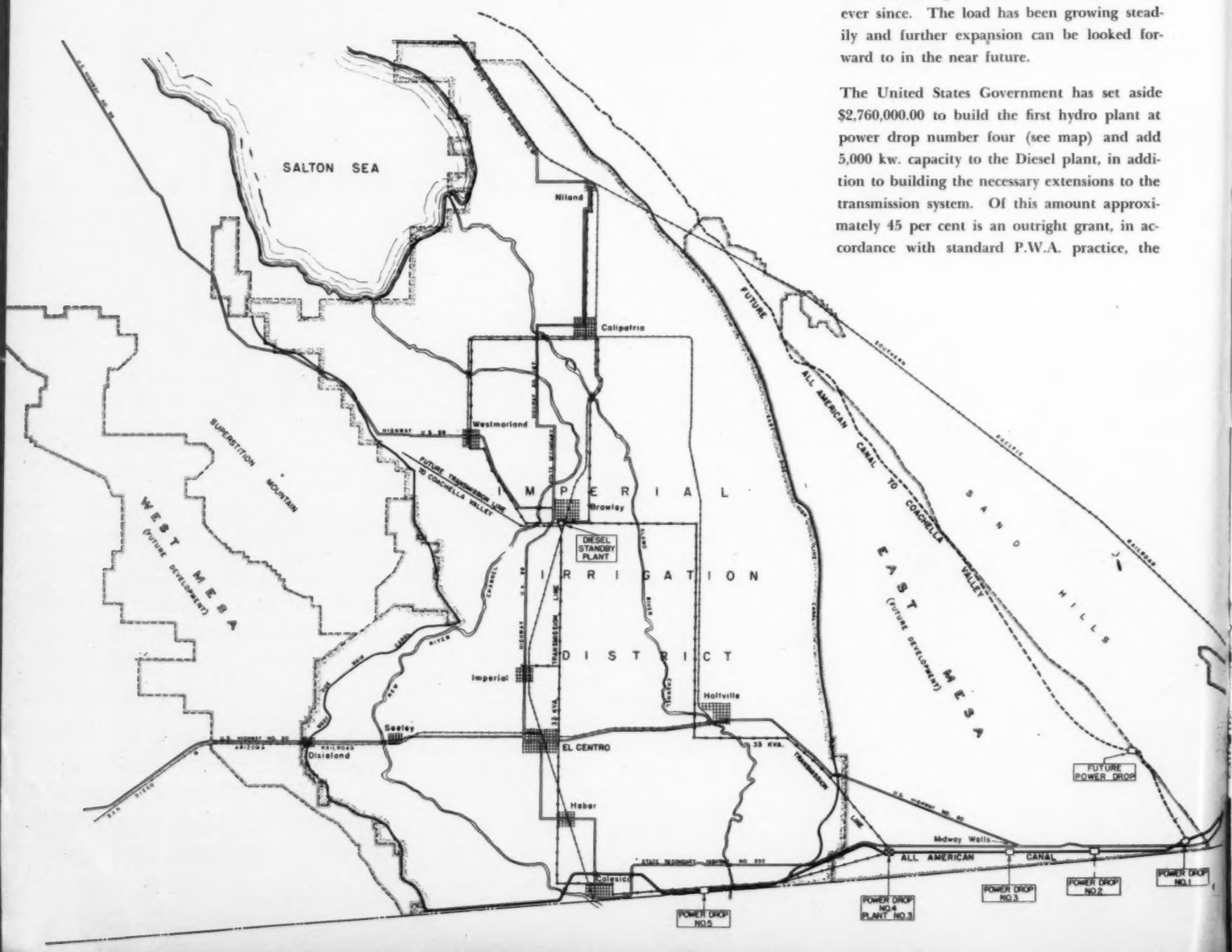
Exterior of Brawley Diesel plant, showing Maxim exhaust silencers, air receivers, etc. Below -- Map showing Imperial Irrigation District and route of the All American Canal.

In 1934 the Imperial Irrigation District decided to take the first step and enter the power business in the Valley by means of a 2,250 kw. Diesel plant to be located in Brawley, this plant being the nucleus around which the contemplated standby plant of 10,000 kw. capacity was to be built. Therefore, in 1934 they entered into a contract with Hooven, Owens, Rentschler Company for three units of 750 kw. each, with the necessary electrical and auxiliary equipment. At that time delivery was contemplated in August, 1934. Due to the many injunction suits brought by the local public utility both in Federal and State courts, delivery and building of the plant were delayed until March, 1936.

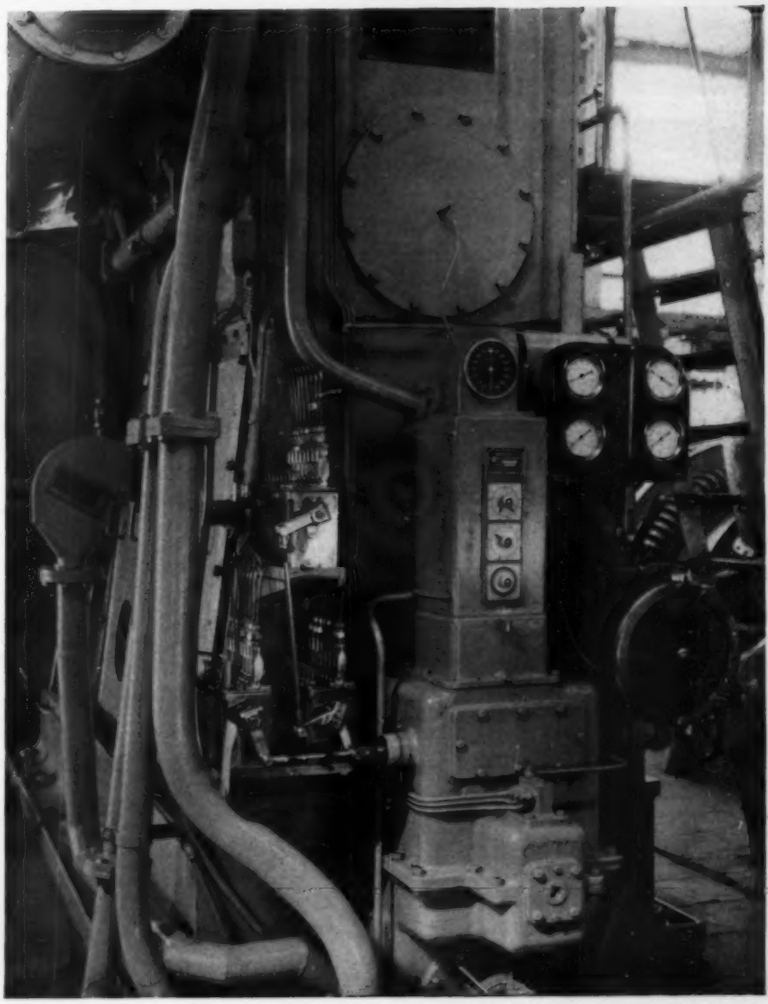
When finally the injunction was lifted by the Federal courts work progressed rapidly, the installation being unique in that the engines were installed and the plant building constructed at the same time, as also was the distributing system for the town of Brawley.

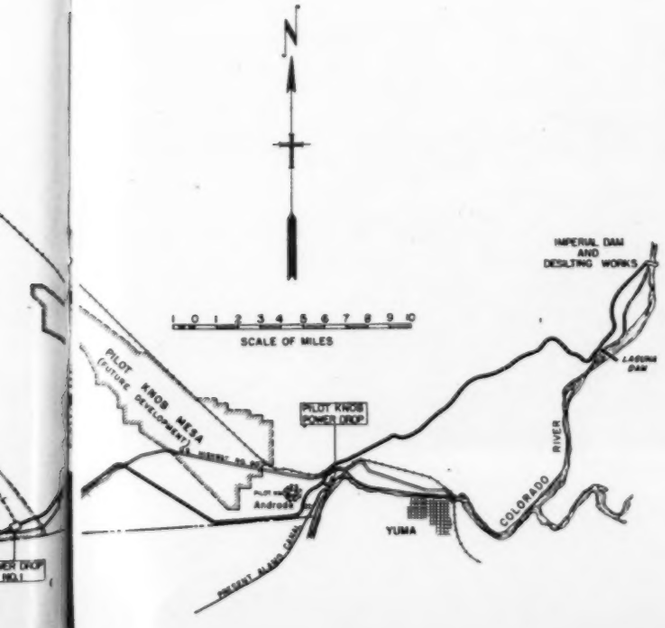
The Diesel plant was put in service May 18, 1936, and has given excellent account of itself ever since. The load has been growing steadily and further expansion can be looked forward to in the near future.

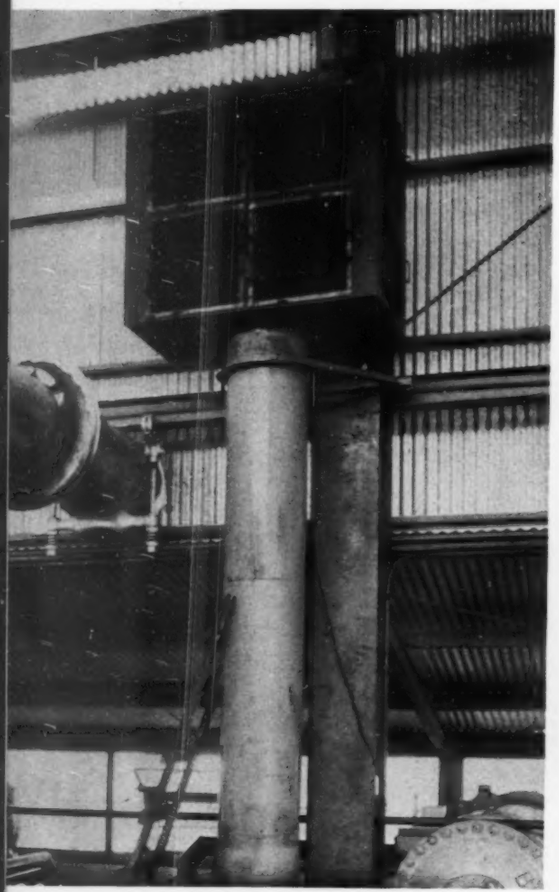
The United States Government has set aside $2,760,000.00 to build the first hydro plant at power drop number four (see map) and add 5,000 kw. capacity to the Diesel plant, in addition to building the necessary extensions to the transmission system. Of this amount approximately 45 per cent is an outright grant, in accordance with standard P.W.A. practice, the



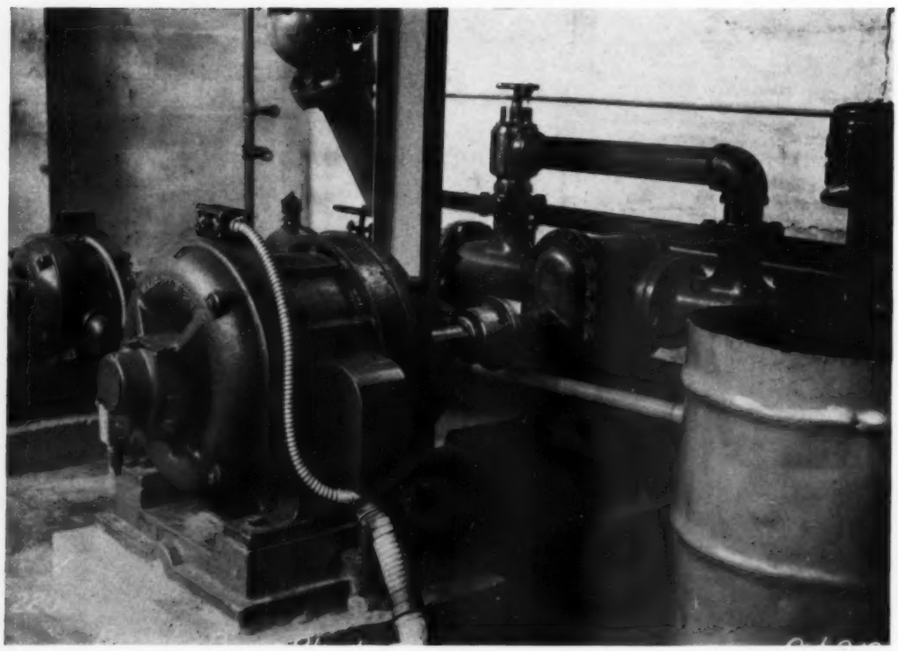
General view of the Brawley Diesel plant, showing the three main Hamilton-M.A.N. engines. Expansion is provided by removal of end rear wall and extension of building to provide new units. To right — Operating end of engine, showing Woodward Governor, Manzel Lubricators, etc.

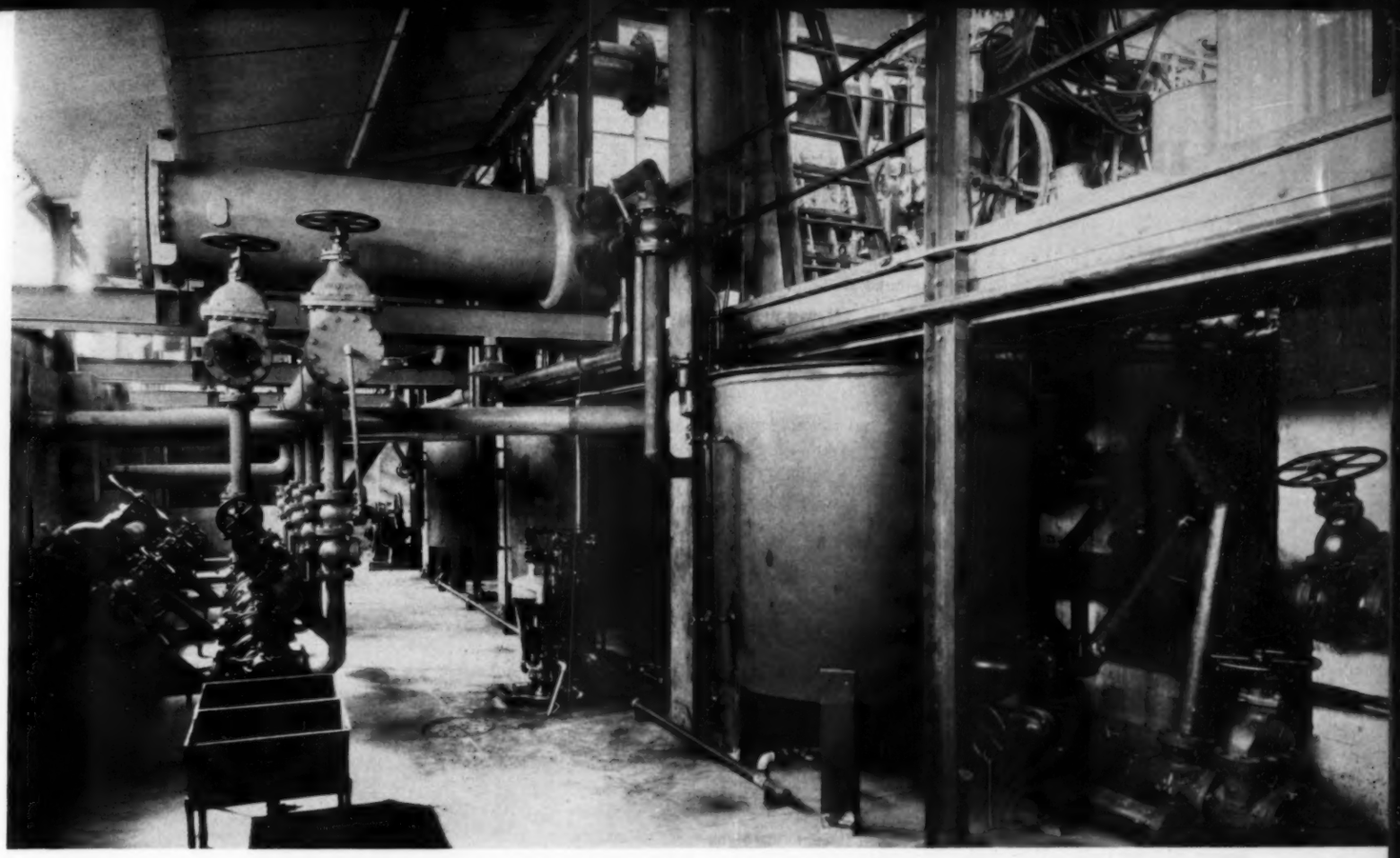






Above — Main switchboard with Allis-Chalmers voltage regulator on left hand side. To left — One of the three American Air Filter air intake units. Below — Allis-Chalmers motor driving Kinney fuel transfer pump.





General view of the basement, showing service pumps to left, Sharples lube oil centrifuge in foreground, Braun heat exchangers above.

balance to be repaid by the Imperial Irrigation District out of earnings. The Rural Electrification Administration also has set aside $700,000.00 to be loaned to the District for electrification of rural areas in the Valley.

Despite the fact that the Diesel plant has only been in service a little over six months, it is operating at a profit, although payment for this plant is being made monthly, spread over a period of four years. Rates have been lowered throughout the territory now serviced by this Diesel plant, averaging over 20 per cent. Service has been greatly improved, as the hazard inherent in the long transmission lines from the Mono Basin across mountains and desert (about 500 miles) has been eliminated.

The people in the Imperial Valley, where a great deal of America's lettuce, cantaloupes, melons, etc., is grown, have many traits of the old Western pioneer stock and once they have set themselves to the task, hell and high water won't stop them. With a steady water supply now assured, and the danger of floods eliminated by the construction of Boulder Dam, this unique portion of America should see its greatest prosperity in the years to come, not the least factor being that the money — a million dollars a year — formerly paid out to the public utility will remain in the Valley.

As stated in the first paragraph, the plant consists of three single-acting, trunk piston, two-cycle, three-cylinder, 21½" x 27½" Hamilton-M.A.N. Diesel engines operating at 240 rpm. direct connected to Allis-Chalmers 750 kw. generators. The engines are simple in design and the latest expression of engineers of the oldest Diesel manufacturers in the world. They are solid injection, of course, employing the M.A.N. patented direct water cooled fuel valves, a design proven over many years as being able to handle a wide variety of fuel oil. This design is also unique in the design of the fuel pump drive. The cams are bolted direct to the crankshaft webs, thus eliminating the customary camshaft with its train of driving gears. The cam motion is transferred to the fuel pumps, located adjacent to the cylinder heads, through a rocker arm and push rod located in the crankcase, making for neat, clean lines and a pleasing appearance. A Connersville rotary blower is bolted directly to the side of the engine and is driven from the crankshaft by means of a Morse silent chain. It is worthy of note also that the oil pump for piston cooling and lubrication and the water pump (Kinney) for cylinder cooling are arranged in tandem on the forward end of the engine and driven from the crankshaft, thus making the unit completely self-contained. A Woodward governor is also located at the forward end over the pumps and alongside the starting and control wheel, concentrating all the control equipment, gauges, Brown pyrometers, etc., in one place.

Pistons are forged steel, with cast iron skirts; there are five piston rings and two scraper rings all American Hammered. There is no separate scavenging manifold, the space around the cylinders being enclosed by means of removable doors and acting as a scavenging air receiver. Pistons are oil cooled and a box provided with glass windows is located on the side of the engine; this box has a visible discharge from each piston and also thermometers on each discharge line. The exhaust manifold is bolted to the side of the engine and the exhaust pipes going to the outside are connected to the engines by means of expansion joints of the stuffing box type. The exhaust pipes lead to separate concrete pits outside and Maxim silencers are bolted on the pits and supported by braces from the steelwork of the building. This design results in extremely quiet operation, the exhaust cannot be heard even standing close by and not at all in the residential section about a city block away.

Lube oil for crankcase lubrication and piston cooling is stored in three 900-gal. tanks — one

. . . . *And now please turn to page 49*

DIESEL EMERGENCY TRACTOR

MAINTAINING a nation-wide reputation as a leader and pioneer in the field of engineering, the Massachusetts Department of Public Works, under Commissioner William F. Callahan, has succeeded in designing and placing in operation a novel type of service tractor that reaches peaks of efficiency never before attained by this type of equipment.

For years the State Department had been severely handicapped by its lack of an adequate service truck that could be used in times of emergency. Operating as it does a large number of pieces of heavy construction equipment in widely separated sections of the Commonwealth, the department had been frequently faced with almost insurmountable difficulties in securing an efficient service truck that could be used for "wrecking" purposes when equipment broke down or slid from the road. In most cases, the only alternative that officials of the department had was to send a truck to Boston, pick up tackle, skids, rigging, etc., and then travel miles in many cases to the scene of the emergency.

The department was also equipped with five semi-trailers that could be used for heavy-duty duties such as delivering signs, carrying large machinery, moving engineers' field offices, etc. In connection with these trailers, the department possessed only one five-ton tractor truck, which, when coupled to the trailer, had an overall length of exactly 45 feet, the maximum length that can be operated in Massachusetts unless a special permit is secured. This five-ton tractor truck was frequently found inadequate, as it was necessary on many occasions to dispatch a second truck to assist in pulling heavy loads over some of the hills in the Commonwealth. The engineers of the department found that in many cases the tractor truck was being overtaxed as high as 200 per cent. This necessarily resulted in breakdowns and costly repairs as well as the loss of the truck's service.

The department also was badly in need of some type of equipment possessing the huge amount of power demanded for such work as uprooting stumps and pulling down trees. The securing of a winch with at least a 30,000 pound pull for such work was an imperative necessity. A more efficient method for loading these stumps and trees for transportation on semi-trailers also was sought by the engineers of the Public Works Department.

Officials of the department, however, realized that the purchase of separate pieces of equipment for the various tasks involved would mean an investment of many thousands of dollars. Nevertheless, remedial steps had to be taken immediately if the high ratio of efficiency of the department was to be maintained.

Faced with these problems, the engineers of the department, under the direction of Commissioner Callahan, Chief Engineer George H. Delano and James Bain, the garage superintendent, suddenly devised the novel idea of incorporating all the needed pieces of equipment in one unit in the form of a tractor that was both a service truck and a semi-trailer tractor truck. Plans and specifications were drawn with the essential aim of attaining both speed and power in the new piece of equipment.

In their request for bids for the tractor, the officials of the Public Works Department specified approximately 75 details of equipment requirements, etc., which were supplied 100 per cent by the Sterling Motors Corporation of Boston. In addition, the new equipment contained a 32,000 pound winch which was furnished by the Walsh Body Company of Cambridge, Mass.

This Sterling tractor has a low gear ratio of sufficient reduction to move 30 or 40 tons over a 20 per cent grade and yet has a maximum speed of at least 50 miles an hour for emergency use. The truck, when uncoupled from the trailer, has sufficient weight to pull at least 16,500 pounds with one strand of cable before it can be dragged along with brakes locked. It possesses spring suspension that can handle at least 100,000 pounds gross weight and which still permits the truck, without load or trailer, to ride comfortably and safely at a reasonable speed.

Seeking an exceptionally large engine, with power enough to do the required work, the Public Works Department secured the installation of a 140 hp. Waukesha Diesel engine with a Bosch fuel system with injectors easily accessible for repairs and replacements. As the Bosch factory is located at Springfield, Mass., it can be easily and quickly reached for repairs. The Public Works engineers also required an extraordinarily large main and auxiliary transmission.

After the tractor truck was delivered, the garage employees, under the direction of Mr. James Bain, the superintendent, of the Public Works Department installed the 32,000 pound winch with its 500 feet of 5/8 cable.

The mountings of the controls on the tractor are unique. After the truck engine is started, the operator can leave the cab and operate the engine throttle, the clutch, and all winch controls while standing on a "safety" tread step between the winch and the rear wheel.

The truck has a 100 gallon fuel capacity tank, a supply which enables the unit to travel 500 miles under the severest conditions without refueling. As a matter of fact, the truck has averaged over 7 miles to a gallon of fuel oil to date, which includes fuel used while the truck was standing idle with winch in operation loading and unloading equipment, pulling trees, etc.; however, on straight runs the tractor with loaded trailer has averaged as high as 10 miles per gallon. The Diesel tractor, doing the same work and covering the same mileage as the gasoline tractor of the Public Works Department, has used only 50 gallons of fuel oil in comparison with 100 gallons of gasoline used by the much smaller gasoline tractor, which, as stated above, needed another truck to assist in moving heavy loads and which did no winch work. Such economy of operation is highly desirable.

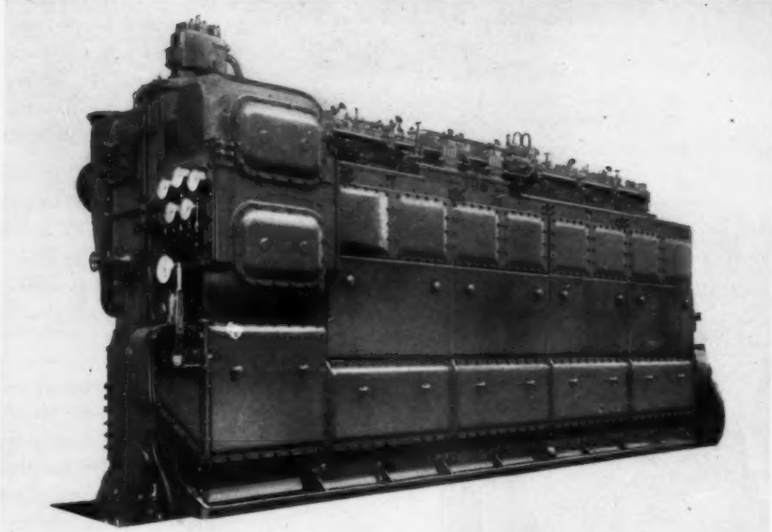
A heavy plate also has been installed between the winch and fifth wheel to allow for a ten ton cement block for ballast when the tractor is used for plowing snow. Auxiliary springs are used in front to support the weight of the heavy duty snow plow when in carrying position.

The trailer was built by the Walsh Body Company of Cambridge, Mass., and is designed to carry 15 tons. Normally, it can be overloaded 100 per cent. It has eight pneumatic tires, spring mounted, and of the tandem rear axle type. The trailer is 20 feet long on the lower deck and seven feet long on the upper deck; it is 39 inches from the ground and has special skids for loading; it has two lashing rings on the top platform and two rings of the same type on the front end of the bottom platform.

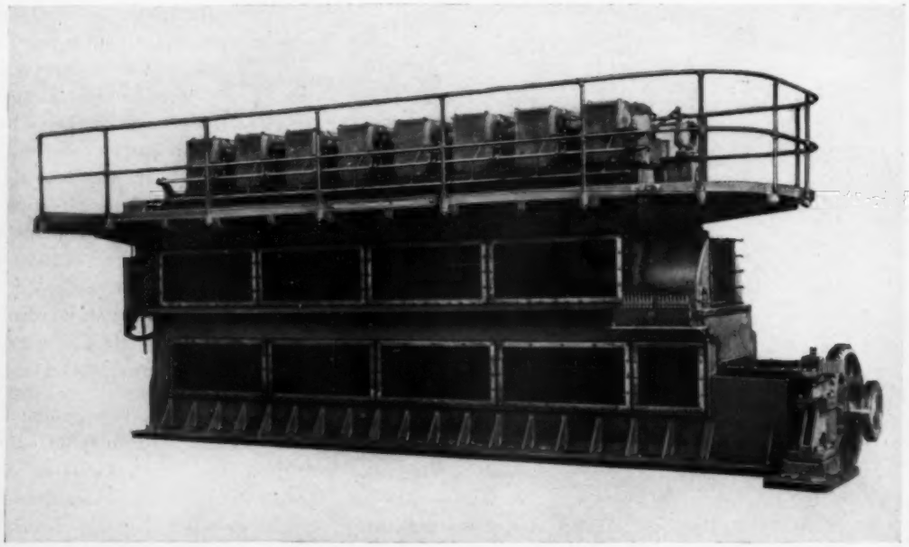
While ordinary service trucks remain in the garage for long periods of time, this super-service Sterling Diesel of the Massachusetts Public Works Department sees almost constant duty. Its uses are extremely diverse. To date, it has been employed in transporting huge quantities of supplies, such as paint, signs, grass seed and tools. Large equipment such as 10 ton tractors, 16 ton steam rollers, and plows weighing up to 20 tons have been handled and transported with ease by the new service tractor. Furthermore, the unit is so rigged that it can be immediately uncoupled from its trailer when an emergency arises and can speed to any point where it may be needed to pull a wreck off the road or to remove a steam roller from a ditch. The tractor unit also has been used extensively on such odd jobs as hauling boats and pulling submarine cable on bridge projects.

The economy and efficiency of the new tractor may be summed up by the estimate of the engineers of the Public Works Department, who declare that the normal time required to load and deliver has been reduced one-third to one-half by the use of this new equipment.

MODERN DIESEL



Alco-Sulzer 2-Cycle Diesel Engines (Sulzer Brothers, Winterthur, Switzerland).
H.P. range—40 to 20,000.



McIntosh & Seymour 4-Cycle Diesel Engines. H.P. range—80 to 8,000.

POWER

The air is full of claims and counterclaims of the 2-Cycle and 4-Cycle advocates. We are not interested in cycle indices, per se.

Every job must meet certain definite requirements. These requirements rarely can be met equally by both types of Diesel engines.

The ALCO, 4-Cycle Diesel engine, thoroughly modern in every respect, occupies a definite field. The ALCO-SULZER 2-Cycle Diesel engine embodies the most advanced ideas, and experience has demonstrated internationally its applicability.

Therefore, ALCO is in the enviable position. ALCO can impartially recommend the engine best suited for every application.

ALCO DIESEL ENGINE DIVISION

AMERICAN LOCOMOTIVE COMPANY
30 CHURCH STREET, NEW YORK CITY

1,000 hp. Renault, three-car Diesel train. Note the large center coach in which the engines are located.

LONDON LETTER NO. 15

By GEORGE LIND

PAST London Letters on Diesel rail traction have dealt almost entirely with developments in the home country and on the Continent. Number fifteen in the series, therefore, by way of a change, will deal primarily with recent shipments of railcars and Diesel trains to countries outside Europe, where interest in such matters has increased tremendously of late. Before carrying out this plan, however, it may be as well to give readers some European railcar news which has just come to hand, and which should be of considerable interest. The first note concerns the French railways.

In France, as in this country, automobile engineering concerns have been among the first to foresee the value of railcars, and have given practical attention to their construction. The Renault factory at Billancourt includes a big assembly shop for railcars, six or seven different designs being manufactured at present. The latest model is a three-car unit, accommodating 140 passengers, with the engine car in the middle. The total length is 195 ft. and the power plant consists of two 55 litre 16-cylinder U-type engines developing 500 bhp. each at 1,500 rpm. Transmission is by a three-plate clutch to a four-ratio gearbox with electro-pneumatic control. Several of these trains are employed on the Paris-Havre route, making two return trips per day, and covering a total distance of 568 miles. The time taken on each trip is 1 hour 58 minutes, or an average speed of 72 mph.

Another interesting new design from the Renault shops is the 80-seater here illustrated. Each of the two bogies contains a rubber-mounted Diesel developing 150 bhp. at 1,500 rpm. The drive is through four-speed gearboxes, the ratios at governed engine speed giving 21 mph., 32 mph., 51 mph., and 74 mph. The overall length is 82 ft., the driver sitting in a centrally placed conning tower.

The second item of news concerns an unorthodox new Swedish rail-traction engine, built by the Atlas Diesel Co., Ltd. It is intended for use in conjunction with the Asea electric trans-

Renault 260 hp. single rail car. The modified conning tower in the center of the coach is the engineer's station.

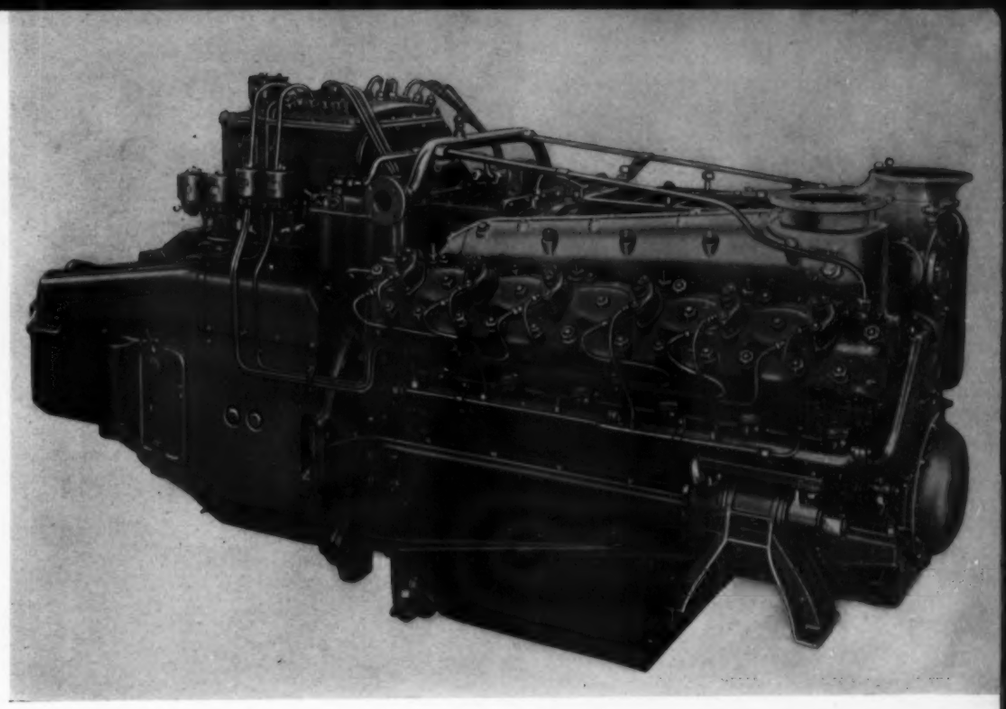
mission, comprising two traction motors on the axles of a power bogie, upon which the engine is mounted transversely with its generator.

The Atlas Diesel Co.'s experience with two-stroke engines has been built into the new power unit, this being of the two-cycle, direct injection, single acting type, scavenged by air from a Roots blower. It has 12 cylinders in two banks of six at 90 degrees and develops 200 bhp. continuously at 1,800 rpm. In the angle between the cylinder banks are the blower, scavenging-air receiver, automatic valves, water pump governor and fuel pumps, which are on top of the generator casing. The rotating units of this group are driven by gears from the six-throw crankshaft, which is carried in main bearings housed in the silumin frame. Below the frame is a cast-steel crankcase to which is secured the generator casing. The engine's piston speed is 1,535 ft. per minute and the weight 12.3 lbs. per bhp.

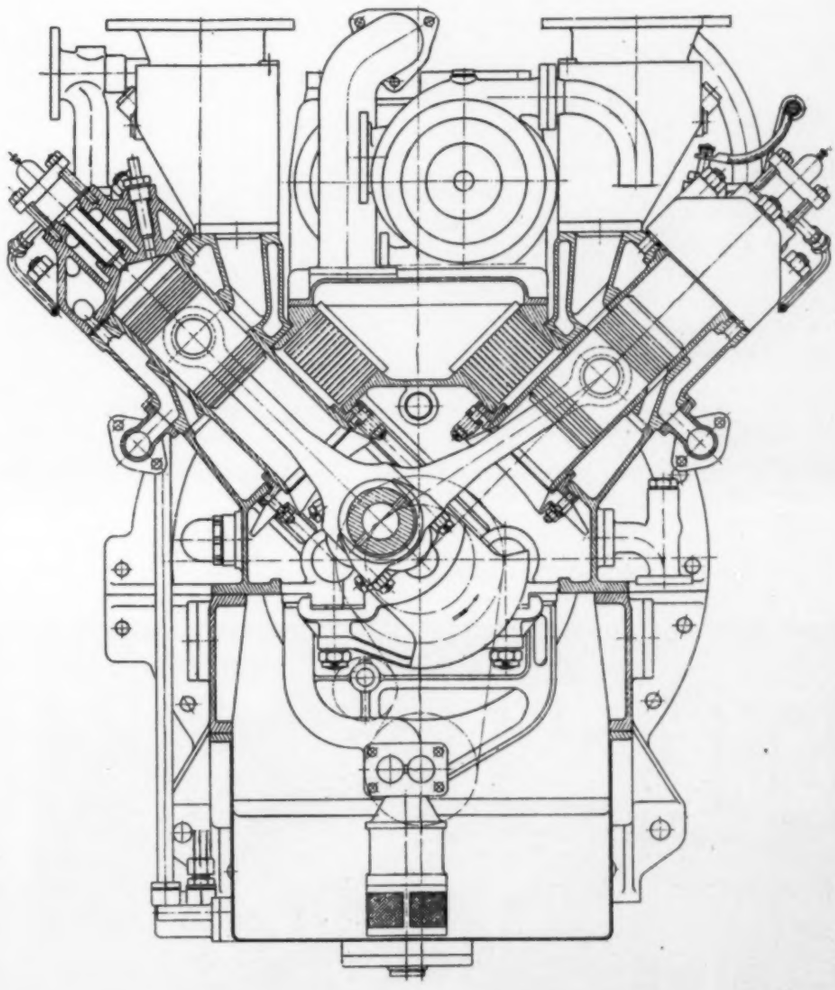
To conclude this section we will jump across to Ireland to see what the Emerald Isle is doing with regard to Diesel railcars. For some while now the London Midland and Scottish Railway (Northern Counties Committee), Northern Ireland, has been running single Diesel cars on the Ballymena-Belfast route, the 62-seater units in question covering approximately 300 miles per day. So successful have these machines proved that a month or two ago it was decided to extend the service with new two-engined cars capable of 70 mph. Construction has again been carried out at the L.M.S.R. workshops, Belfast, but the power units and hydraulic torque converters have been purchased from Leyland Motors, Ltd.

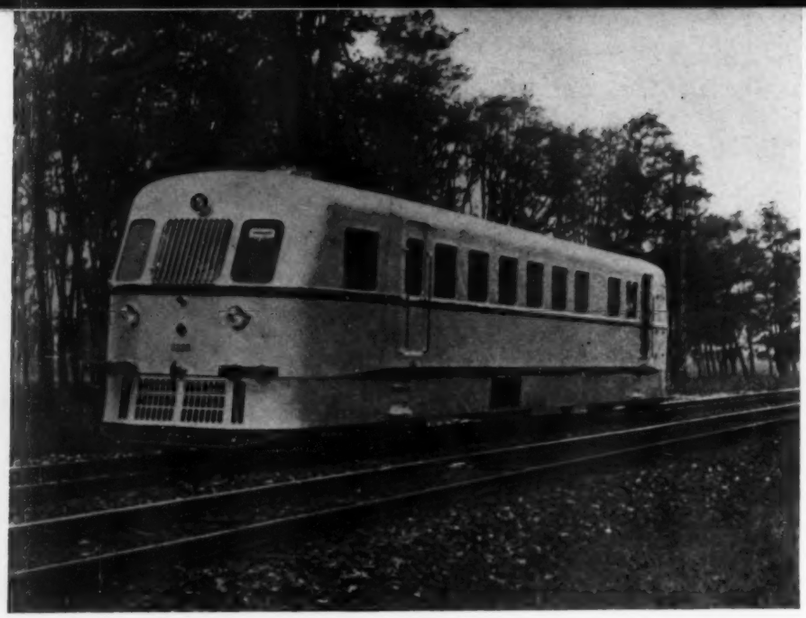
The engine used is of the 10-litre type, developing 130 bhp., the drive passing through the Leyland torque converter, which provides the equivalent of all indirect ratios and a free wheel. The engine and converter groups are carried in a sub-frame below the centre of the car chassis. From each torque converter the drive is by propeller shaft to the final transmission set in the inner axle of a bogie; the control is operated electro-pneumatically. The cars can carry 80 passengers on reversible seats, and in solo form weigh 25 tons.

Turning now to the other countries and other climes here, then, are some details of the latest railcar developments in Australia. Ever since the end of the war the Queensland Government Railways have been steadily developing railcar units for branch line traffic, but hitherto all the cars have been of the petrol type. Attention has now been turned to Diesel-engined vehicles, of which there are two in ser-



12-cylinder, Atlas, two-stroke traction Diesel generator set, with cross-section shown below.





One of the 240 hp. Ganz-Jandrassik Diesel railcars on test for the Egyptian State Railway.

Railcar and two trailers for the Queensland Government Railway, powered by 102 hp. Gardner Diesel. Below — Erection floor of Sulzer Bros., Ltd., Winterthur, Switzerland, showing four Sulzer Diesel railcars under construction.

vice and another three under construction. The first Diesel unit was rebuilt from a petrol car and is powered by an A.E.C. six-cylinder engine giving 130 bhp. at 2,000 rpm.

During last summer a further railcar was set to work, but the power unit in this case is a 102 bhp. Gardner engine running at 1,700 rpm., and this engine is fitted also to the three cars at present under construction. As may be seen from the photograph, the car is of the light six-wheeled type, with the engine located over a small bogie at one end. The single axle at the other end takes the drive from the gearbox. The car, which carries 82 passengers when hauling the two trailers shown is now in service on the Kilcoy branch, where it has to negotiate grades of 1 in 55, and 1 in 60. This branch line is only 34 miles long, and over it the railcar makes a mileage of 600 a week. Twice a week it runs down to Brisbane, 30 miles distant. The car and trailer bodies are of all-steel construction, and were built at the Ipswich works of the Queensland Government Railways.

Towards the end of last year, the Egyptian State Railways placed an order for ten eight-wheeled Ganz-Jandrassik Diesel-mechanical railcars with Ganz & Co., of Budapest. These cars were ordered because it was thought desirable to extend the railway company's activities in a modern and progressive manner, Diesel stock being the obvious solution to the short distance passenger traffic problem. Since then a further ten cars have been ordered of the same type, thus bringing the State railways' Diesel stock up to 20 strong.

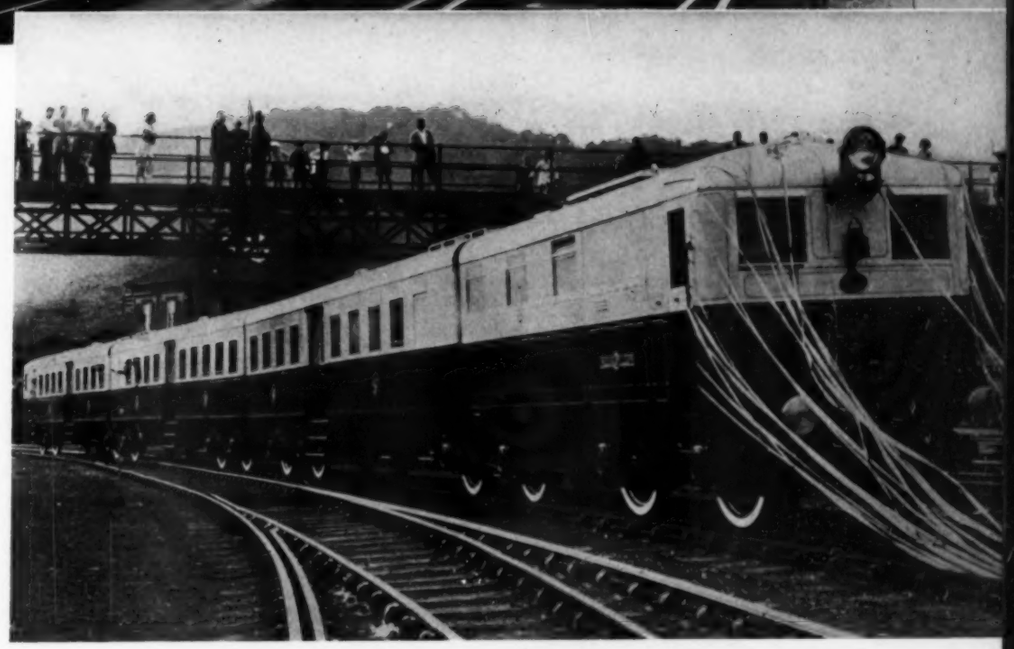
The cars are of a neat, streamlined shape, each designed to carry 28 first class and 54 third class passengers. In ten of the cars, the compartment immediately behind the driver's cab is arranged for the carriage of mails, while in the remaining vehicles this space is used for carrying luggage. The service speed is 60 mph. and normally two cars are coupled together. Propulsion in each case is by a Ganz-Jandrassik six-cylinder high-speed Diesel rated at 240/300 bhp. A Ganz five-speed gearbox is provided, power being transmitted to both axles of the power bogie.

Among other countries to whom a large amount of Diesel-powered rolling stock has been supplied by European manufacturers are the South American republics. One such example is the Ferrocarril Provincial, of Buenos Aires, who have recently taken delivery of four Diesel-electric railcars from Sulzer Bros. of Winterthur. These units are built for metre gauge line and have 20 first class seats and 42 for

Original 62-seater Diesel railcar on the Ballymena-Belfast Route of the Northern Ireland Railway.

Below — Photograph of the inauguration of the very successful "Cometa," the original Diesel-electric train of the Sao Paulo Railway.

Below — Plan and elevation drawings showing general arrangements of the new Armstrong-Whitworth Diesel-electric train for Brazilian service.

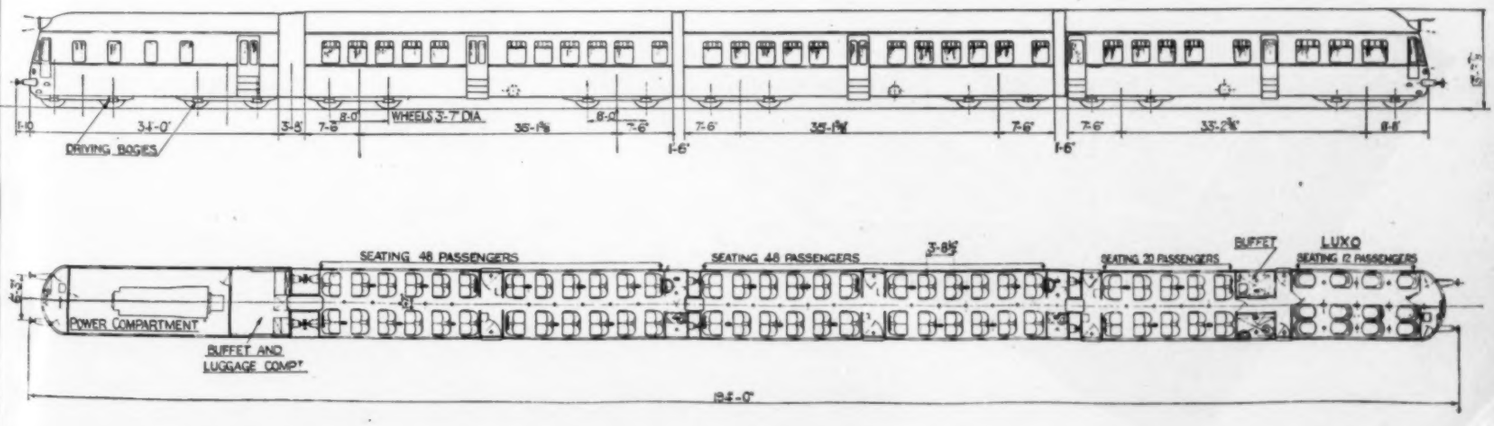


second class passengers. The engine is a Sulzer four-stroke design developing 270 bhp. at 1,100 rpm., and it is installed at the forward end of the railcar in a separate compartment, adjacent to the driving compartment.

The engine is intended to operate at four fixed speeds, controlled from the driver's cab, and the new electrical system of transmission developed by Brown, Boveri & Co., is such that the output of the engine is maintained practically constant, and it cannot, therefore, be loaded unwittingly. The length of the railcar is 66 ft., and the weight, fully loaded, is 43.4 tons. The maximum speed for which the car is designed is 80 kilom. per hour, or 50 mph.

A further instance of South American interest may be given in the announcement of the Sao Paulo (Brazilian) Railway Co., Ltd., some

. . . . *And now please turn to page 53*



TWO MILLION ZEPHYR MILES ANNUALLY

Burlington Route Adds Two New Seven-Car Diesel Trains

OVER two million miles per year are now scheduled by the Burlington Railroad for its enlarged Zephyr operations, with the new Big Twins in service, Chicago to St. Paul-Minneapolis, and the Ozark State inaugurating a daily round trip, St. Louis to Kansas City.

The *Mark Twain* after "pinch-hitting" in the Chicago-Denver overnight run for five months and subsequently making a round trip daily in the Twin Cities service is "back home" — St. Louis to Burlington, Iowa.

Actually the fleet of eight Zephyrs will roll up the impressive total of 2,154,595 miles within 12 months — an average of 5,903 miles per day, marking perhaps the swiftest evolution in the history of any industry. This new chapter in advanced rail transportation began as recently as November 11, 1934 when the first Diesel-powered streamlined train started its regular chore, Lincoln to Omaha to Kansas City and return.

All eight Zephyr trains were designed and manufactured by the Electro-Motive Corporation, and are powered by Winton Diesel engines, which have been described in previous issues of DIESEL PROGRESS.

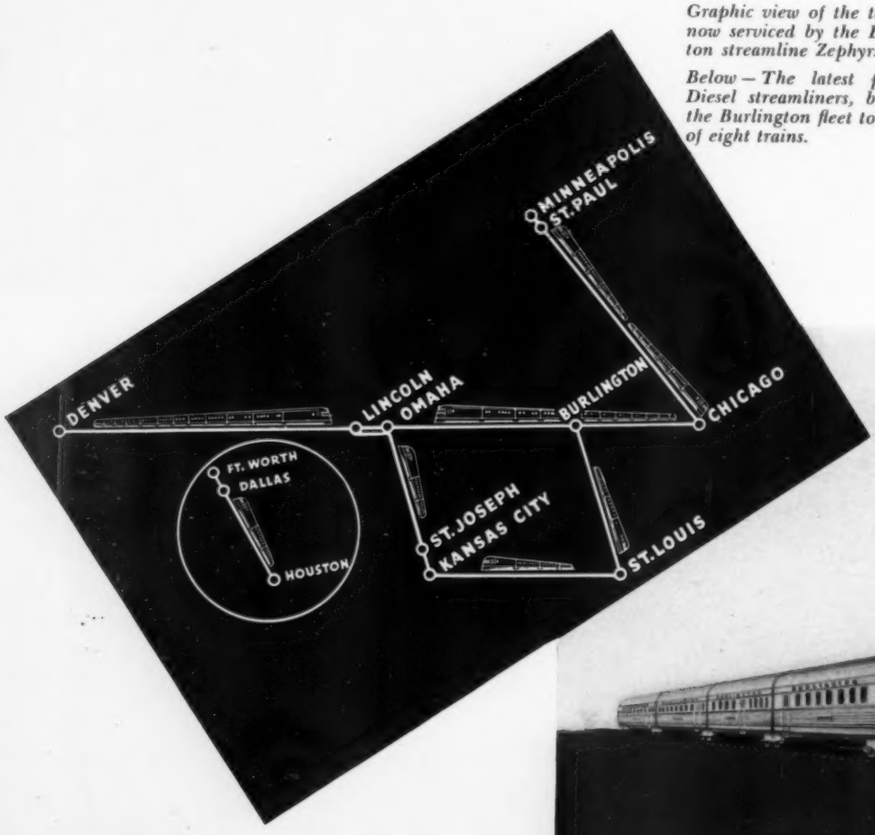
The first Zephyr from November 11, 1934 to April 30, 1936, inclusive, carried a total of 110,700 revenue passengers. It replaced two steam trains with attendant economy to the operating department of the Burlington. While the elapsed time for this run between Lincoln and Kansas City in each direction is five hours, twenty-five minutes, or an average of 46.2 mph., this schedule includes a forty-minute lay-over at Omaha. The elimination of that lapse reduced the actual running time to four hours, forty-five minutes, or an average of 52.6 mph. The fastest time of the steam trains that preceded this Zephyr operation was six hours, 35 minutes, with no allowance for any "dead-time" at Omaha or an average of 38.0 mph.

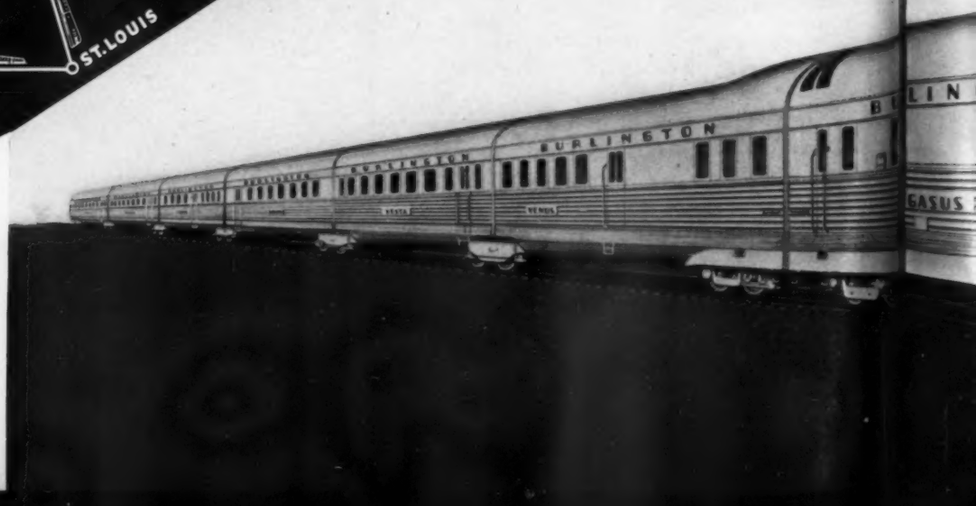
The *Pioneer* Zephyr has proved to be a tremendous success in this Missouri River run. During the first year of its operation, it carried 50 per cent more revenue passengers than the steam trains carried during the previous year, while the increase in passengers per mile, due to the longer average haul, amounted to 113 per cent.

The original Zephyr was taken off of its epoch-making run of 500 miles per day to inaugurate, along with the *Mark Twain*, the speedy overnight service, Chicago to Denver, on May 31 of this year. This schedule drastically reduced the previous fast steam operating time from 25 hours, 15 minutes to 16 hours West and 15 hours, 50 minutes East. The steam train operation called for 41.1 mph., while the three-car coach passenger-accommodating small Zephyrs averaged 64.6 mph. Westbound and 65.6 mph., Eastbound.

Graphic view of the territory now serviced by the Burlington streamline Zephyrs.

Below — The latest pair of Diesel streamliners, bringing the Burlington fleet to a total of eight trains.





The *Mark Twain* Zephyr, running mate to the *Pioneer,* before inaugurating this fast overnight service to Denver, established the record for the fastest three consecutive miles in rail history, negotiating that distance at the rate of 122 mph. as well as six consecutive miles at the average rate of 120 mph.

The new Denver Zephyrs (December, 1936, DIESEL PROGRESS) are the giants of the Burlington fleet of stainless steel passenger trains. It requires two and one-half cars to house their 3,380 hp. Diesel engines with a total of 40 cylinders. They went into regular service, November 8, after one of these great cruisers of the rail reduced the world's record of the *Pioneer* Zephyr between Chicago and Denver, to 12 hours, 12 minutes, averaging 83.3 mph. for the intervening distance, which on this dash, was 1,017 miles — Union Station Chicago to Union Station, Denver.

A satisfactory patronage is reported on the Big Denver Zephyrs even though their inaugural run was of recent date and their capacity is more than four times that of the little three-car streamlined trains they supplanted.

Some idea of the comfort afforded passengers is indicated by the two interior views of the new streamliners.

The popularity of the six-hour, 30-minute run to and from the Twin Cities could not even be filled by the arrangement of double duty of the smaller units, hence the new and larger Zephyrs with much greater capacity and each supplied with a full length diner and modernistic cocktail lounge. The power plant for the bigger Twins in each case will be 1,800 hp. The forward end of the second car carries additional Diesel equipment and generators for operating lights, refrigerators and air-conditioning units; as well as radio-phonograph equipment.

Nothing more aptly illustrates the trend toward

Dining accommodations on the new seven-car Zephyrs recently placed in service by the Burlington Lines.

fast day-time travel than the record of the little Twin Zephyrs from April 1, 1935 to October 31, 1936, during which a total of 180,136 revenue passengers were carried. With the advent of this type of railroad service, a readjustment of travel, days against nights, was brought about, the proportion now being 60 per cent by day and 40 per cent by night whereas prior to the inauguration of Zephyr service along the Mississippi River, the relative percentage was 25 per cent by day and 75 per cent by night.

The *Sam Houston* which went into service October 1 of this year, did not replace any conventional steam train, but rather supplemented the existing service between Houston, Dallas and Fort Worth. While the train has only been in operation a few weeks, it has had practically a capacity load each way every day. Interesting statistics compiled as a result of interviews on the train over a period of the first six weeks of operation, supplied the answer to the invariable question, "Where does this increased railroad passenger traffic come from?"

A careful survey of this period and specific train, demonstrates that 46 per cent of the total traffic was initiated because of this service, which otherwise the railroad would not have obtained: 33 per cent from private automobiles — 6 per cent from buses — 7 per cent from planes. 53 per cent of the total would have taken the steam train had the new type Diesel power operation not been available, while only 1 per cent of the total admitted their ride was prompted by curiosity.

Thus the new Diesel streamlined trains have marked the definite beginning of a new era in comfortable and profitable railroad transportation. The phenomenal success achieved within one year by this fleet of silver Zephyrs is conclusively shown to be based upon better service to the public, shorter operating schedules and dependable service.

THE CASCADE LAUNDRY

By JOHN W. ANDERSON

EVERY laundry faces a heat transfer problem and a power problem, and seeks to combine the solution of the two problems to give the highest overall economy. After all, power is the result of converting heat into work, so the idea is to start with the heat source and balance the outcome to meet the relative demands of hot water, steam and power. If the "heat balance" is right then the results will spell efficiency and economy.

The Cascade Laundry in Brooklyn is claimed by the owners to be the largest laundry in the world. The company has some 1,100 employees and serves the entire metropolitan area with its own pick-up and delivery service consisting of 175 trucks. They offer several services, including household laundry, dry cleaning, rug cleaning, linen supply, also cleaning and laundry service to yachts, with pick-up and delivery service to the docks.

The company was founded many years ago and the present chief engineer, Mr. Max Troy, took charge of the power department in 1920. The growth and development of the power plant since then is interesting, and shows how the heat balance may change over a period of time as such an establishment grows and as conditions change.

In 1920 there were two 150 kw. generators driven by Skinner uniflow steam engines installed in an engine room 60 by 20 feet. There was one 374 hp. coal fired steam boiler. In 1924, the steam and power demands had increased, and a 300 kw. General Electric steam turbo-generator and another boiler of the same size as the first one were added. In 1929 the engine room was doubled in size to become 60 by 40 feet to accommodate further machinery additions and changes. This time another 200 kw. uniflow engine generator set and a 1,000 hp. oil fired boiler were added. The existing boilers were converted to oil firing. During all of this period, Edison power was purchased for night service when the plant was in general shut down, and for elevators. Of course, too, this connection served for standby service.

But time has brought changes and the management has been very progressive in keeping the plant up to date as well as in getting new business requiring more capacity. Electrically operated machinery for handling clothes and machine parts has been installed on a large scale. The washing machines used were designed by Mr. Troy, and especially built to his specifications. They are shown in one of the illustrations and will accommodate 2,000 lbs. dry weight of laundry at each loading. They are the largest washing machines in the world, are made of Monel metal and measure 60 by 147

The Cascade Laundry is strictly up to date in architecture as well as cleaning methods and power facilities. The new Diesels are located in the older section at the extreme right.

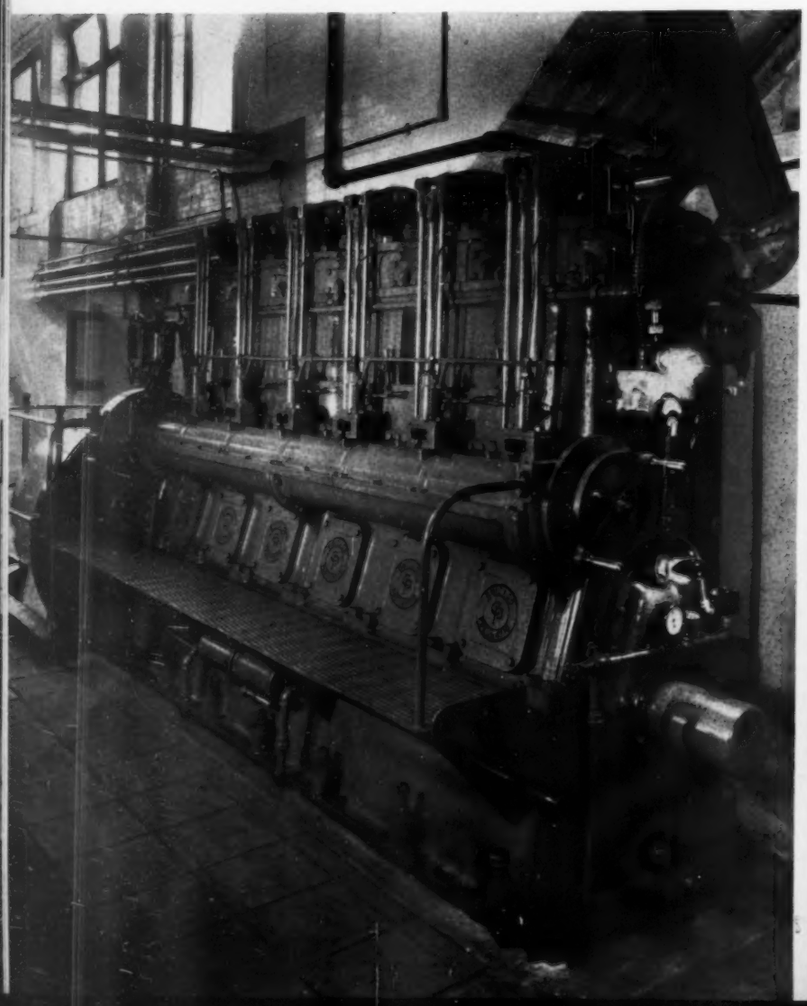
inches. All this brought about a heavy increase in the electrical load without a corresponding increase in steam demand. When the turbine was called upon to carry this extra load, the steam consumption increased all out of proportion, left a surplus of steam available and upset the heat balance. Mr. Troy decided it was time to bring in the Diesel engine and take advantage of its economy. So in November, 1936, one 200 kw. and a 35 kw. Diesel engine generator were placed in service. The turbo-generator was shut down, but was kept for standby use. This also made it possible to shut down one of the smaller boiler units.

The large Diesel unit consists of a 300 hp. six cylinder four cycle Chicago Pneumatic Tool Company Diesel engine directly connected to a 200 kw. Crocker Wheeler generator. The small unit is a six cylinder four cycle Buda engine purchased through the Buda Dieselite Sales Corporation. It is direct connected to a 35 kw. Westinghouse generator which was previously a part of the motor generator set which served the night load when the Edison current was purchased. For when these last changes were made, the plant became entirely self-sustaining and all outside connections even for emergency and standby service were cut off.

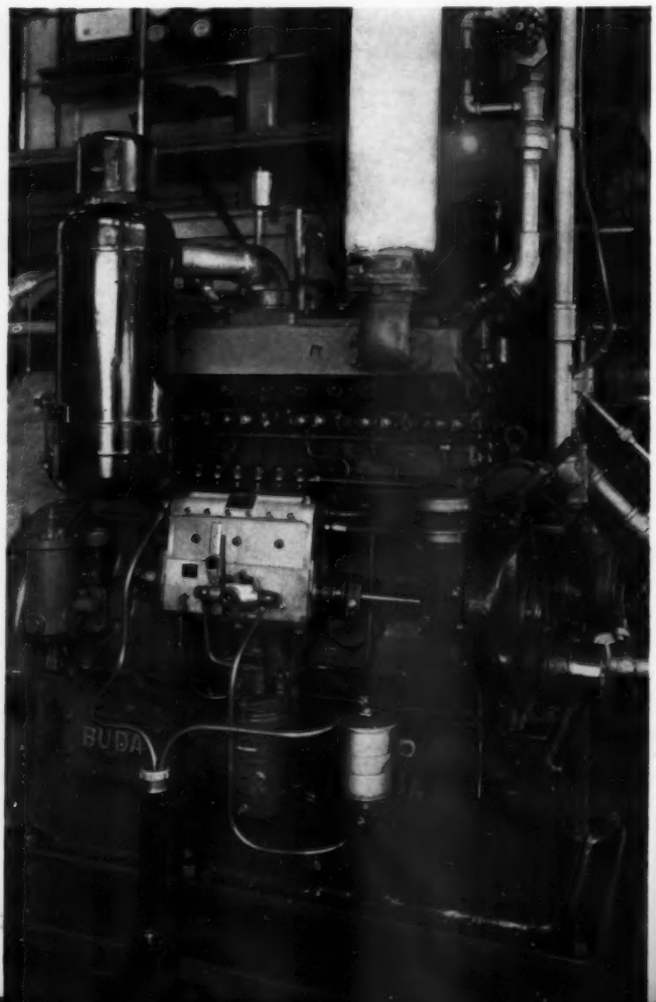
The large Diesel engine takes its air from the engine room through a Burgess filter and silencer attached to the engine. Exhaust is through a Maxim silencer. The lubricating oil system is entirely self-contained on the engine except for the sump tank. Oil drains from the bedplate to this tank and is pumped back to the bearings through a Cuno filter and a Groco cooler. Speed of the engine is controlled by a Pickering governor. There is an Alnor pyrometer for measuring the exhaust temperatures, and a Bristol exhaust temperature alarm to warn the operators automatically in case of excessive temperature.

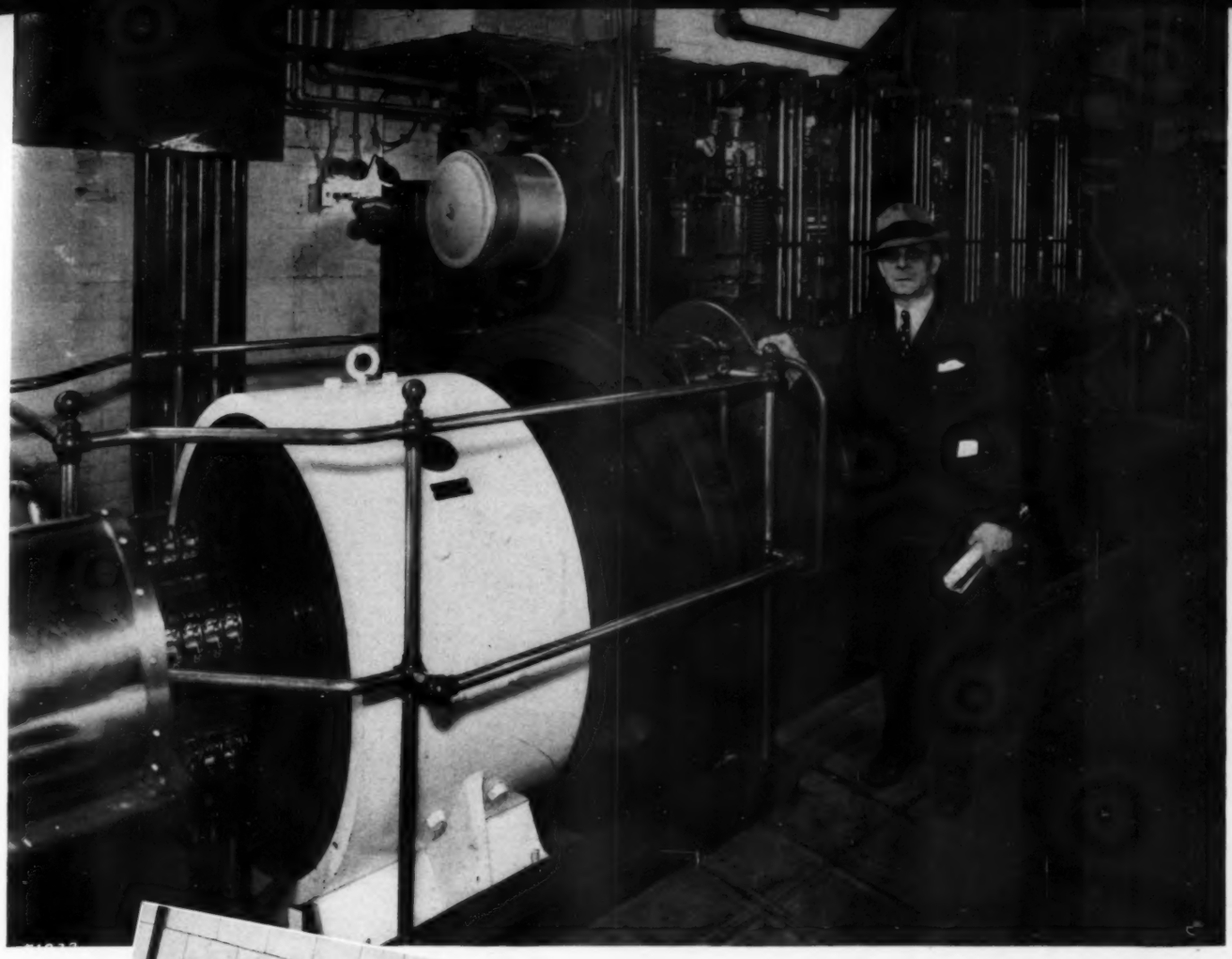
Auxiliary equipment includes a motor driven Viking lubricating oil transfer and standby circulating pump, two motor driven Viking fuel transfer pumps, and a Nugent filter. Starting air is supplied by Quincy compressors, one of

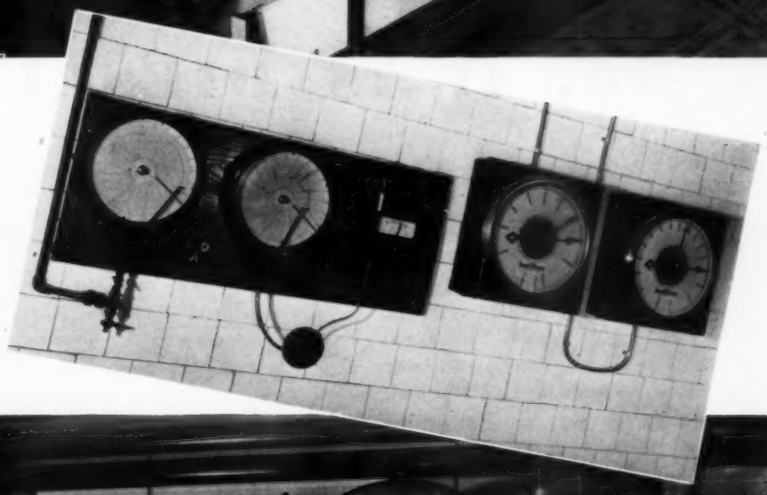
The 300 hp. Chicago Pneumatic Diesel which effects a saving of $35.00 per day.



An additional saving of $200.00 per month is contributed by this 35 kw. Buda Dieselite generating unit for night service.







Max Troy, Chief Engineer at Cascade with his Chicago Pneumatic Diesel-Crocker-Wheeler generator unit.

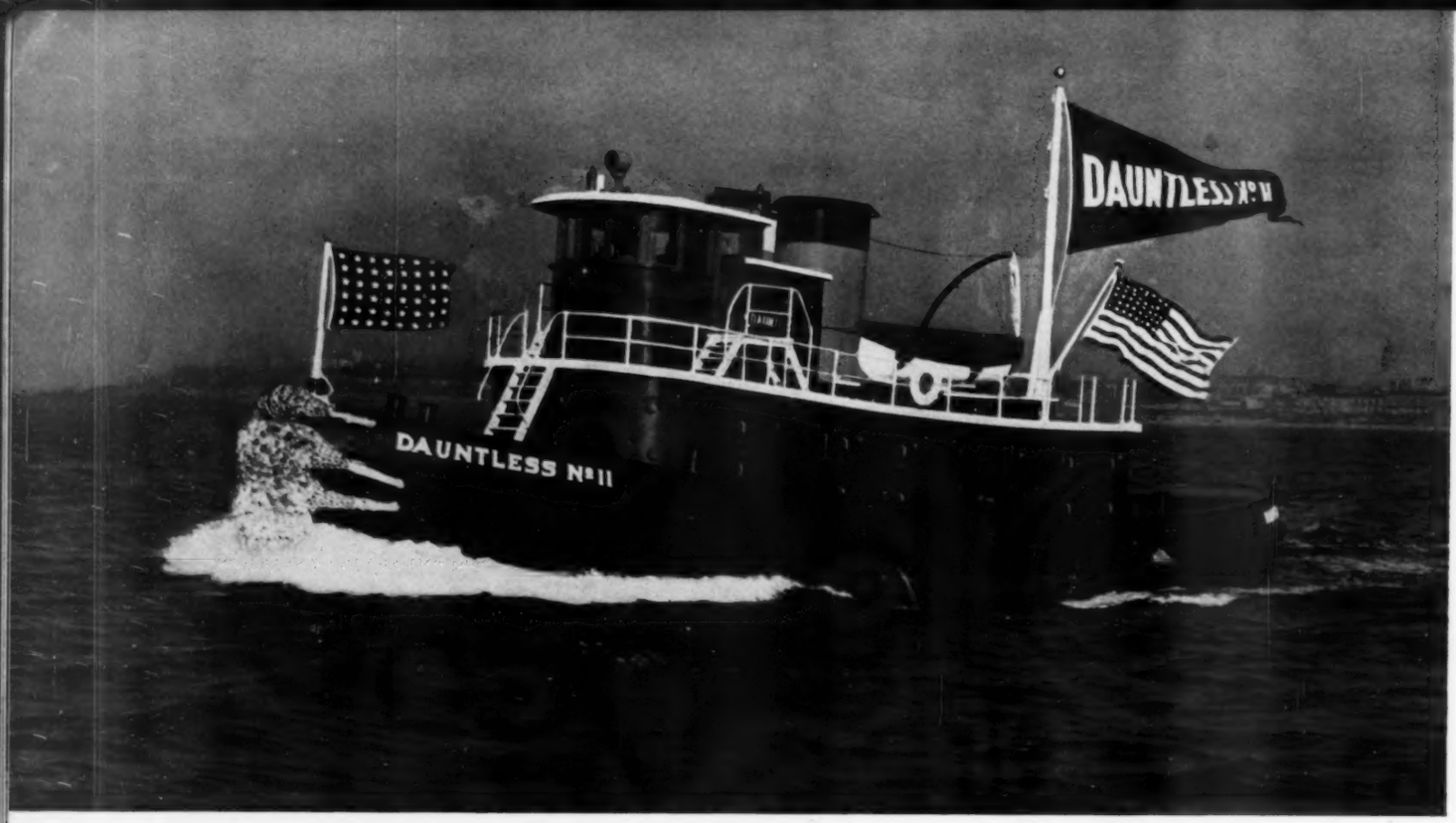
Left — Diesel and boiler fuel oil is constantly and conveniently checked by Liquidometer and Levelometer remote reading tank gauges. The two on the left of the Board are Bristol pressure recording gauges.

Below — Quincy compressor and air tanks for starting.

them motor driven and one driven by a Nuway gasoline engine.

The Buda engine takes its air through a United air cleaner and the exhaust is through a Burgess silencer. Cooling water temperatures are closely regulated by a Fulton Syphon temperature control on the discharge which bypasses as much water as is necessary back to the suction. Electric motor starting is used with Leece-Neville equipment.

Fuel for the boilers and for the Diesels is stored in separate underground tanks. In order to know how much fuel there is in the tanks at all times, and in order to be able to measure the fuel consumption of the boilers and engines, each tank has a distant reading gauge . . . . *And now please turn to page 48*



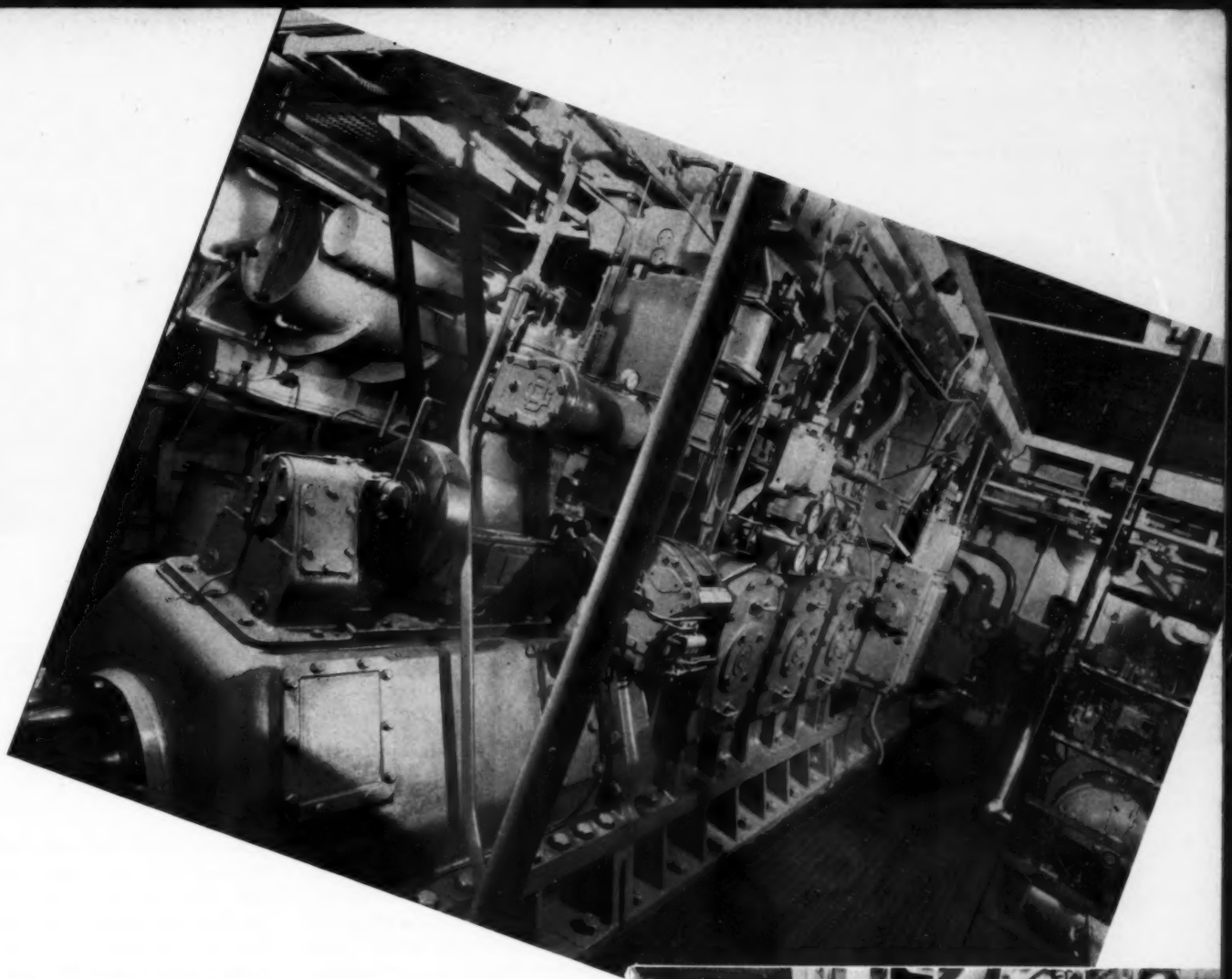
DAUNTLESS NO. 11 IS DIESEL

IN 1936 when the Dauntless Towing Company decided to build a new tug the company had been in operation for fifteen years. The Dauntless fleet at that time numbered ten steam tugboats, five coal-burning and five oil-fired. One of these, a 1,500 hp. vessel, holds the distinction of being the largest tug on the Atlantic seaboard. The Dauntless reputation in marine circles is excellent and well known. It is worthy of note, therefore, that the power specifications for the new *Dauntless No. 11* called for a Cooper-Bessemer Diesel engine.

Captain Nielson, President of the Dauntless Towing Company, voiced several very sound reasons for the departure from steam to Diesel. He states, "I believe that Diesels are the modern type of power. It is necessary to refuel a steam tug every four days, while our Diesel can give uninterrupted service for three weeks without refueling. In addition to the operating economy, our Diesel tug requires three less crew members than a steam vessel of corresponding power. We are well pleased with our new Diesel tug." Captain Nielson amplified one of the above points by explaining that when he sent a steam tug from New York to Boston it was necessary to refuel for the return trip. Due to an existing unfavorable price differential he is penalized on all coal purchased in Boston instead of New York. Obviously, the decided advantage to which Captain Nielson refers is not only less operating time lost by his Diesel tug for refueling but also his ability to purchase fuel where lowest prices prevail due to the 400 per cent greater cruising range.

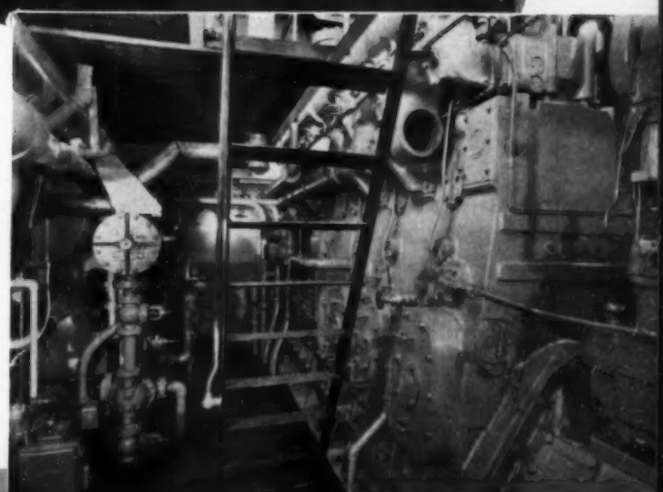
The *Dauntless No. 11* is 82 feet long with a breadth of 24 feet and a variable draft of from 8 to 10½ feet. The latter is controlled by fresh water ballast according to whether she is engaged in coastwise, river or canal service. Interchangeable pilothouses permit operation through the New York State Barge Canal. With two double staterooms forward of the upper engineroom and two more aft, it is possible to accommodate the crew without resorting to the old-time dark and stuffy forecastle. A completely furnished galley is situated at the extreme forward end of the deckhouse.

The Cooper-Bessemer main propulsion Diesel is a six cylinder, 15½ by 22 inch unit developing 625 hp. at 250 rpm. A unique feature of this installation is that all auxiliaries necessary to operation under way are incorporated into the engine structure. These include such items as the Gardner-Denver 2-stage, water-cooled starting air compressor, Purolator fuel oil filter, centrifugal raw water pump, a plunger type jacket water pump and a pair of lubricating oil pumps. The operating station is located on the starboard side at the after end of the engine. Here are grouped all necessary



controls including a Reliance tachometer and the usual pressure gauges and thermometers.

Other auxiliary equipment not integral with the main engine also contribute to smooth and trouble-free operation. A Hill Diesel generator set furnishes electricity when the boat is not under way. Lubricating oil is cleaned by means of a Goulds Hydroil purifier. Both an Andale lubricating oil cooler and heat exchanger for the closed, fresh water cooling system are installed. This arrangement completely eliminates sea water from the engine cylinder jackets. An Electro-Dynamic generator is belt driven from the main engine. Complete Cory bridge-engineroom signal devices were furnished by the Bendix Marine Products Company. A Brown pyrometer indicates cylinder temperatures. And, lastly, in accordance with the recent safety ruling by the United States Steamboat Inspection Service, a Maxim SC-2 exhaust silencer not only eliminates noise but possible sparks as well. Quite obviously, the *Dauntless No. 11* is a most complete and modern tugboat. Although in active service less than a month she is evoking highly favorable comment.



Engineroom interiors of the "Dauntless No. 11" (top to bottom) — starboard side of main Cooper-Bessemer Diesel showing the operating controls and, in the foreground, the Gardner-Denver compressor; port side of main engine with Goulds Hydroil and Andale heat exchangers appearing to the extreme left; upper engineroom showing exhaust uptake to Maxim silencer.

DIESEL TRUCKS MAKE MONEY

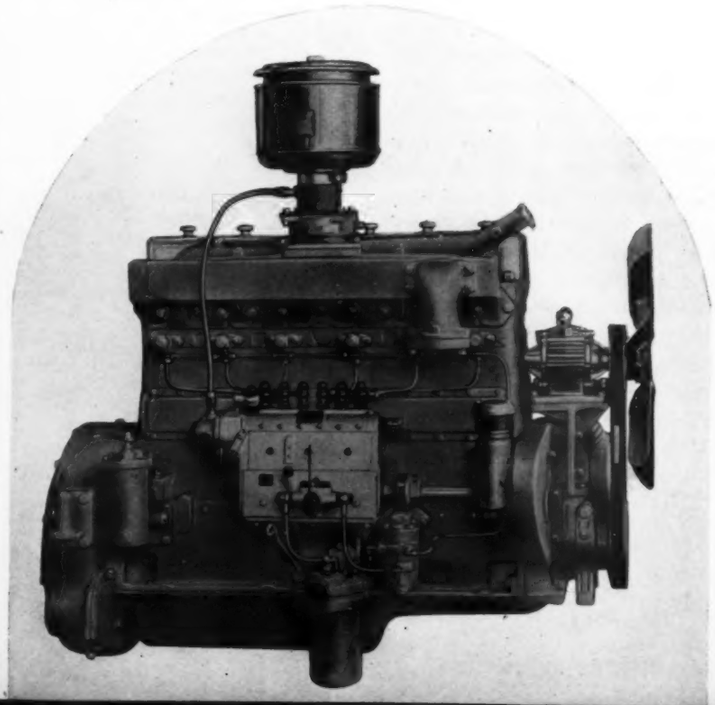
Savings Reported on St. Louis-Louisville Run

FAR-SIGHTED truck operators all over the country are rapidly taking advantage of Diesel engine operating economies. As a result, these companies are increasing their profits materially, even though the initial investment in the Diesel engine is somewhat greater than that for gasoline. One of countless specific examples is the case of Husman and Roper Freight Lines. This organization, with headquarters in St. Louis, operates two trucks powered by Buda Diesel engines. One Buda was selected to replace a gasoline engine and one was purchased to power a new truck. The latter was built by The Hug Company, of Highland, Illinois, and, with its Diesel engine, is a splendid example of what the modern, up-to-date tractor and trailer should be. Now let us see what it should do. With a total gross load of 39,000 lbs., this combination made the trip from St. Louis to Louisville and return, a distance of 566 miles, at an operating expense of $3.85 (55 gallons of fuel at 7 cents per gallon). Obviously, no other type of transportation could handle that tonnage at such an economical rate and on the same time schedule.

For those who feel that more representative figures can be obtained by comparing operating expenses of the same truck powered first by a gasoline engine and later by a Diesel, the following statement by Husmann and Roper to the Buda Company will be of interest:

"We are running this unit approximately 600 miles a round trip (each trip in a period of 48 hours). With the former gas engine, we were using an average of 120 gallons at an average cost of 15.4 cents per gallon. With the Buda unit, covering the same mileage, we are using an average of 60 gallons of fuel oil at an average cost of 7.8 cents per gallon plus 3 cents tax. During the first 20,000 miles of operation this unit used only 2 quarts of lubricating oil aside from regular changes every 1,000 miles. In spite of gross loads which sometimes run 45,000 lbs., we have never had occasion to use the lower gear. Absence of smoke is very conspicuous." In the face of such facts, it is easily understood why aggressive individuals and fleet owners are demanding Diesel engines in their trucks.

The Buda Diesel engine which is serving truck operators so well. Operating records confirm Diesel superiority in the motor truck fields.



Germany re-arms with the Diesel! Three of the new Junkers Ju 86 high-speed bombing planes flying in formation near Bueckeberg during the Thanksgiving festivities. In the nose and amidships are gun turrets, with another one underneath the fuselage.

Below — Loading a heavy piece of machinery into a tri-motored Junkers Ju 52/3m. This sturdy all-metal plane has a top speed of 208 mph., and a cruising speed of 196 mph. at 12,000 ft. It can carry 2,000 lbs. of freight or bombs!

DIESEL AIRCRAFT NEWS

By PAUL H. WILKINSON

NEARLY 2,500,000 miles flown by Diesel-engined commercial airplanes to the end of 1936 — that is *real progress!* This imposing mileage, flown over Deutsche Lufthansa air routes, was accomplished *without serious difficulties or fires,* thanks to the efficient Junkers *Jumo 204* and *Jumo 205* engines installed on six different types of airplanes.

The first regular flights made in 1931 by a *Junkers F-24* plane amounted to only 1,634 miles. During 1932, however, much more activity took place and 33,614 miles were covered. With the addition of Focke-Wulf *A 17* planes, the yearly total for 1933 was 61,496 miles. The following year saw a big increase to 278,397 miles, due to the addition of the tri-motored Junkers *Ju 52/3m* to their fleet. In 1935, with the help of the Junkers *G-38* and *Ju 86* models, the total amounted to 597,695 miles. Last year, the flights of the Dornier *Do 18* planes helped to boost the yearly total to 1,457,000 miles.

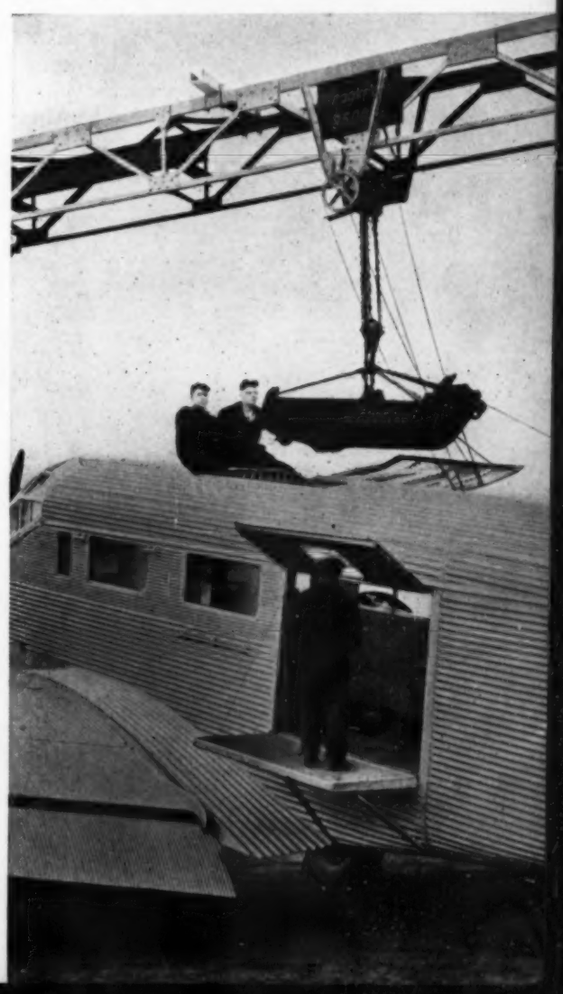
To the actual total of 2,429,836 miles flown during the 1931-1936 period can be added an equal mileage representative of the flights of numerous Diesel-engined military planes in Germany. This would bring the total close to 5,000,000 miles for Diesel operation. Figures such as these, proving beyond a doubt the reliability of the Diesel, should be convincing enough even to the most sceptical!

During 1937, several new Diesel engines are due to make their appearance. From the Junkers factory comes news that turbo-supercharging and Prestone cooling have been successfully applied to the *Jumo 205-C,* with the result that its sea-level power of 655 hp. is maintained up to 20,000 ft. This means that it also has an excellent performance at altitudes of from 20,000 ft. to 30,000 ft. At its critical altitude (20,000 ft.), the engine's fuel consumption is not increased — it still remains at 0.35 lb. per hp. per hour.

Another addition to the Junkers line, which is now available, is the *Jumo 205-D.* Although it is of the same size as the *205-C* model, refinements have been made whereby it develops 700 hp. at 2,600 rpm. and has a continuous power output of 590 hp. at 2,450 rpm. With a weight of 1,140 lb., this works out at 1.63 lb. per hp. for the new engine, compared with 1.90 lb. per hp. for the *205-C* model.

A still more powerful engine, the *Jumo 206,* will soon be in production. With a rating of over 1,000 hp., its weight to power ratio has been reduced to 1.40 lb. per hp.

From France comes the news of a new liquid-cooled Diesel which was exhibited at the Paris Aircraft Show. The Coatalen *12 Vrs 2* is a twelve-cylinder vee-type engine of conventional four-stroke design, equipped with a centrifugal supercharger. With a rating of 550 hp. at 2,000 rpm. at 10,000 ft., it weighs 1,170 lb., or 2.12 lb. per hp. As Coatalen designed a number of gasoline aircraft engines in England, including the Sunbeam, his new Diesel should have an excellent future.



PISTON AND VALVE COOLING BY MEANS OF SUPERCHARGING

By B. J. VON BONGART

THE high and relatively constant torque developed by a Diesel engine is one of its inherent superiorities over the gasoline engine. There are other superiorities, of course, such as fuel economy, lower fuel cost, freedom from electric ignition gadgets, etc., but since these – while important considerations – lie outside of the realm of power – i.e., torque, they will not be dealt with here.

Supercharging has thus far been regarded as a means for increasing an engine's power. In the gasoline engine field, automobiles are provided with supercharged engines in order to obtain quicker acceleration and/or higher maximum speed; and aircraft engines are being supercharged so as to obtain full aspiration in the rarefied air of the upper strata. Since the great majority of Diesel engines – for the time being at least – are of the heavy or medium duty type as exemplified in the fields of stationary, marine and mobile engine applications (to which may be added Diesel locomotives and Diesel-engined trucks), the crowding of an extra amount of power into a given size engine has not been considered necessary.

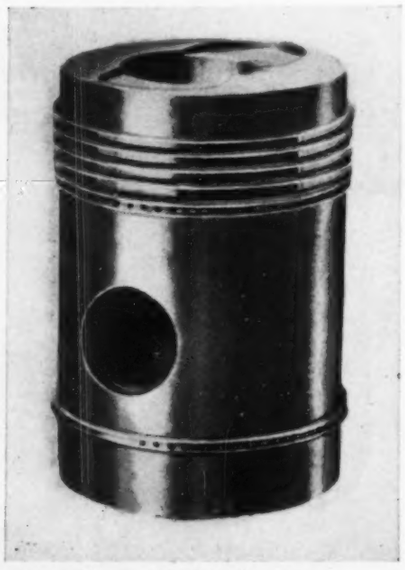


Fig. 1. Diesel engine piston.

Furthermore, rapid acceleration, while a talking point for automotive engines, is of no real value for Diesel engines – except perhaps for locomotives – since there are no Diesel powered passenger automobiles as yet. Compensation for the loss of breathing capacity at upper strata has not thus far received consideration, partly because Diesel engines in operation at mountain peaks – where rarefied air is a major consideration – are few indeed, and aircraft Diesel engines are, in so far as our country is concerned, still in the embryo stage. This, then, explains why the Diesel fraternity his ignored the supercharger. That a supercharger could be immensely useful for piston and valve cooling rather than merely for increasing an engine's power is a very recent discovery.

In none but small Diesel engines – i.e., those of a bore of less than 14 inches – can the piston dissipate its heat to the cooled cylinder walls without some external aid. Pistons for engines of over 12 inches bore are customarily provided with oil, or in some instances, with water cooling. In Fig. 1 is shown a typical Diesel engine piston of the uncooled type, able to dissipate the heat which it has to bear.

The piston shown above was selected at random. That it contains an aperture within its center, which is intended as an air-chamber, is of no moment for our considerations. Piston heads may be flat or crowned; sometimes they have two recesses for the valves so that the latter remain open when the piston is at T.D.C. But none of these details of piston construction concern us here, since any type of uncooled piston would illustrate the point, namely, that the piston must dissipate its heat to the cooled cylinder walls.

Large engines are provided with externally cooled pistons; a representative form is shown in Fig. 2.

As will be noticed, the piston contains a hollow space and two pipe lines, one of which acts as a feeder and the other as a discharge line. The cooling medium used may be oil or water.* The pipe lines are provided with joints, and thus can follow the reciprocating motions of the piston.

In order to utilize compressed air as a cooling medium rather than for mere supercharging purposes, slight modifications in the valve timing must be made. Fig. 3 illustrates a typical valve timing arrangement for a Diesel engine of medium speed.

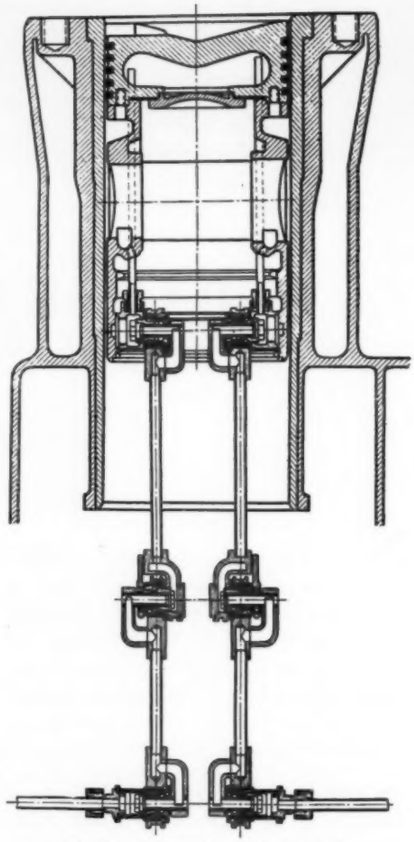


Fig. 2. Externally cooled piston.

It will be observed that the intake valve opens 10° past T.D.C. and closes 45° past B.D.C. The exhaust valve opens 50° ahead of B.D.C. and closes 10° past T.D.C.; hence the intake valve opens at the moment the exhaust valve closes. Of course, such a valve timing as illustrated

. . . . *And now please turn to page 46*

*Lubricating oil is the preferred cooling medium, for, when used for this purpose, any slight leakage at the joints will merely add a small amount to the lubricating oil contained within the engine's crankcase. If fuel-oil is used, however, then leakage may gum the lubricating oil. And when water cooling is resorted to, leakage will inevitably cause the formation of an oil-water emulsion within the crankcase, which in turn may result in serious trouble. Water cooling is more efficient, and oil has a tendency to carbonize on the underside of the piston head, but, everything considered, lubricating oil is the best compromise.

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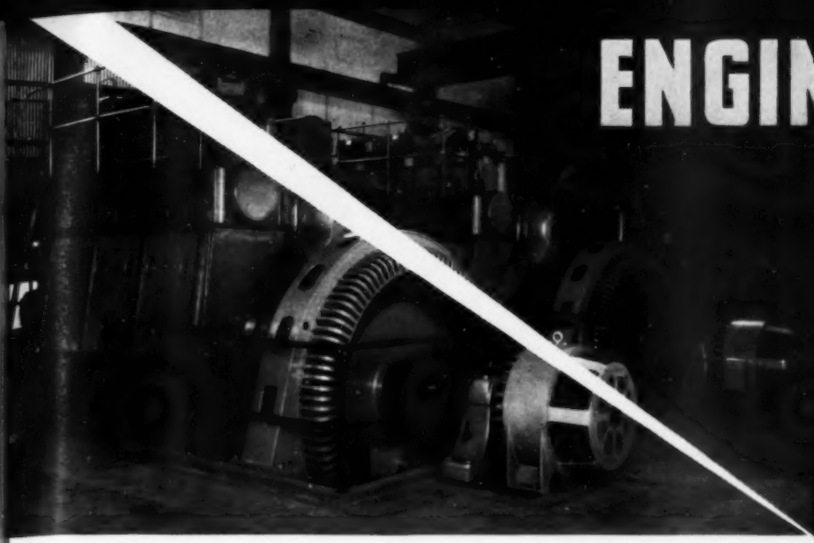

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PISTON AND VALVE COOLING

. . . . *Continued from page 44* . . . .

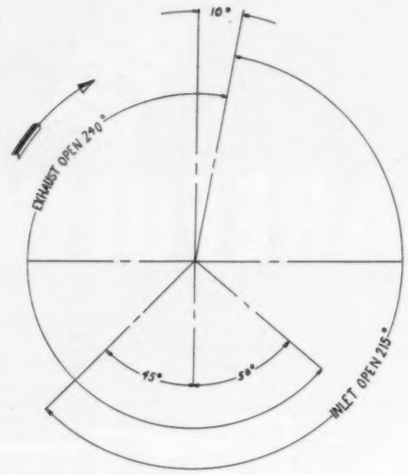


Fig. 3. Valve timing, medium speed engine.

is by no means universal. Some designers consider the closing of the intake valve at 45° past B.D.C. too late, and others claim that opening the exhaust valve 50° before B.D.C. is too early; and again, there are those who prefer to have the intake valve open before the exhaust valve closes; that is to say, the intake valve may open as much as 5° before T.D.C. so that both valves may be open for a period of 15° (crank degrees). That the valve timing in any given case is influenced by the speed at which the engine is to operate, the bore-stroke ratio, and the clear area of the valve opening is manifest.

In modern high speed Diesel engines, where maximum cooling is the main objective, intake valves are opened as much as 80° ahead of T.D.C., and exhaust valves are so timed as to close as late as 60° past T.D.C. so that both valves are open simultaneously for as long a period as 140°! In Fig. 4 is illustrated a Diesel engine head with both valves open (the piston being near T.D.C.), the incoming compressed air blowing over the piston head and past the hot exhaust valve, cooling the two in a manner and to a degree heretofore not dreamed of.

In Fig. 5 is shown the result of air-cooling a plain piston, similar to that of Fig. 1. For oil or water cooled pistons, the additional cooling obtainable by means of an air-blast over the piston head would also be beneficial in that the extra cooling thus provided prevents carbonization of the cooling oil within the crevices of the hollow piston (see Fig. 2), which is bound to occur whenever the piston operates at too high a temperature. The desire to prevent

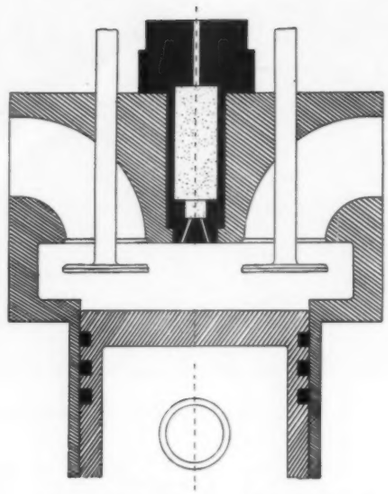
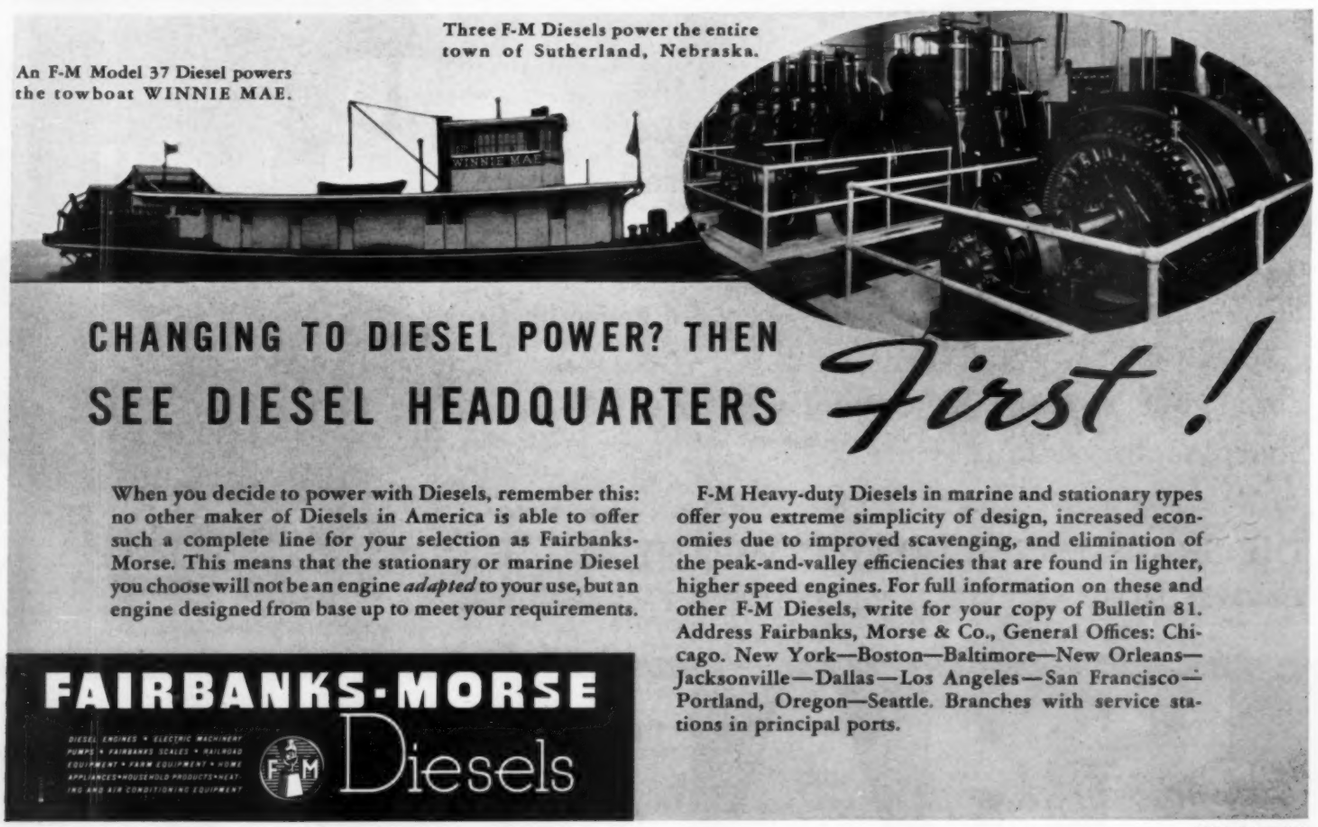


Fig. 4. Diesel engine, both valves open.

carbonization of the cooling oil has forced many a designer to employ water for the cooling of the piston, but, as has just been said, the danger of emulsifying the lubricating oil by the seepage of the cooling water at the joints makes such a cure worse than the disease.

The air-blast blowing directly over the top of the piston head (its hottest part) will remove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heat more readily than the cooling-oil, whose ability to absorb heat is hindered by the comparatively thick piston-head (see Fig. 2). That an air-blast will cool a plain piston such as that of Fig. 1 will readily be admitted by all, but some may doubt that there is much advantage in blowing air over an oil-cooled piston, Fig. 2.

The following will illuminate this point:

The compressed air as delivered by the supercharger (blower) drives the exhaust gases out, and as the comparatively cool air stream continues to blow over the piston head and past the exhaust valve, the temperature of an uncooled piston has been reduced by as much as 200° F., and that of an oil cooled piston by more than 120° F. Exhaust valves which formerly showed color while the engine was in operation were cooled so that no color was noticeable, and even water cooled valves of large engines required less frequent valve-grinding, a sure sign that the valves were operating at far lower temperatures.

It may safely be said that the average 4 stroke cycle Diesel engine has a fuel consumption of 0.44 lb. per hphr., which, if an oil of average quality is used, means that the engine generates approximately 8,000 Btu. per hphr. Since not all of this heat can be utilized, some 30 per cent of the total, or 2,400 Btu., must be dissipated by the cylinder walls, the head and the piston. Assuming now that the piston is called upon to dissipate 30 per cent of this heat (the balance being taken up by the walls and

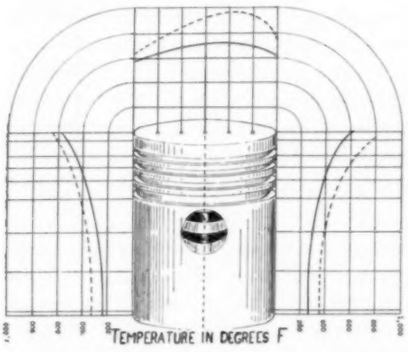

Fig. 5. Temperature difference, plain piston. Solid lines with, dotted lines without air cooling.

head), it must thus absorb and dissipate 720 Btu. per hphr. Experience has proved that a temperature difference of 70° F. between the incoming and outgoing cooling oil, represents the optimum value, the temperature of the outgoing oil not to exceed 150° F. It has also been proved that a temperature rise of 1° F. per lb. of cooling oil per hphr. may readily absorb 0.35 Btu., which then, using an oil of a specific gravity of about 7½ lbs. per gallon, calls for a quantity of cooling oil which may be stated thus:

$$Q = 720 \cdot \frac{0.35}{7.5 \cdot 70} = +5 \text{ gallons}$$

Thus, for an engine of a size of 250 hp. per cylinder – assuming a 1,500 hp. 6 cylinder engine – the quantity of cooling oil needed is 250 x 5 x 6, or 7,500 gallons per hour. Of course, no such immense quantity of oil is ever used for cooling purposes, since the oil circulates and re-circulates, traveling for a part of its cycle through water cooled oil-coolers. Yet, a certain minimum quantity of cooling oil is essential in order that the 70° F. may be dissipated by the oil cooler and the oil may again enter the piston at about 80° F. and thus function as an absorber of the piston heat.

Since 1,250 gallons of cooling oil per piston per hour are thus required (assuming 250 bhp. per cylinder), the quantity of circulating cooling oil needed is from 20 to 21 gallons per second. When such pistons were subjected to air-blast cooling by means of supercharging, a temperature drop (at the piston head) of some 120° F. was recorded, which permitted reducing the circulating cooling oil from 5 gallons per hphr. to but 3½ gallons, or, stating it in another way, but 14 gallons per second per piston, a saving of 33 per cent in cooling oil, with the additional feature of freedom from oil carbonization within the crevices of the inner piston head.

The supercharger or blower needed for the furnishing of the compressed air may be of the rotary or centrifugal type, may be gear or exhaust gas driven, or operated separately and driven by an electric motor. True, the operation of a blower (supercharger) requires extra power; it may consume as much as 15 per cent of the total horsepower developed by the engine. But in return it will increase the power of a given engine by as much as 40 per cent – a net gain of 25 per cent in actual useful horsepower – if this is wanted: and in any event, it will cool the pistons and exhaust valves of an engine to an extent that is really astonishing.

The determining of the proper valve timing (valve overlapping) presents difficulties that must be solved for each particular type of engine, but it is well worth the effort. Those experienced in this field need no more than two or three experimental cam layouts to readily ascertain the optimum valve overlapping for any given case.

You may need these specifications tomorrow!

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Diesel engine accessories are vital elements in every Diesel installation! Accurate specifications of intake silencers, air cleaners, engine hoods, and exhaust mufflers should be in your files at all times. Send for these reference sheets at once.

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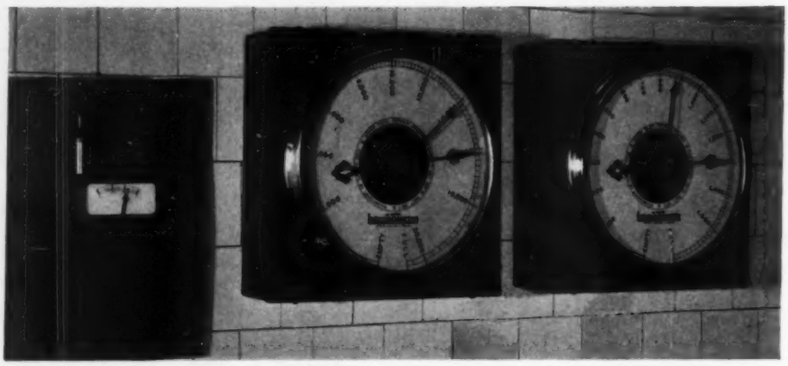

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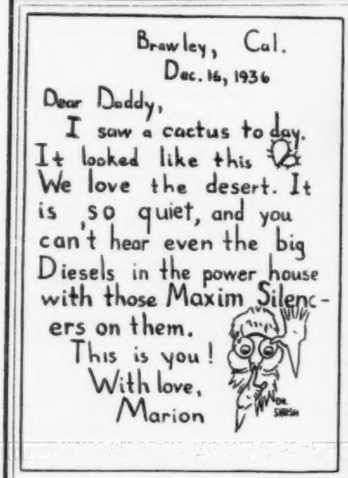

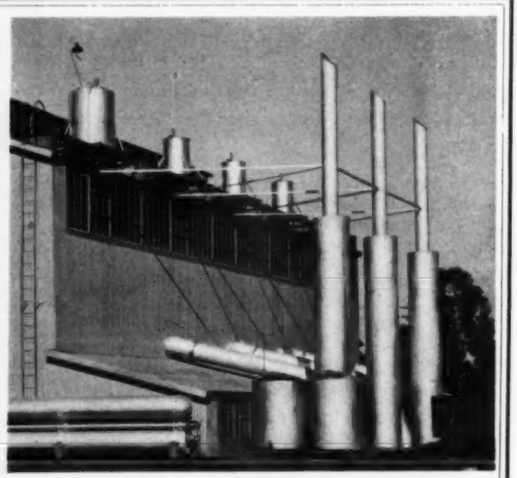

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CASCADE LAUNDRY

. . . . *Continued from page 39* . . . .

with the dial in the engine room. There are two Liquidometer tank gauges and a Midget Levelometer.

The heat balance problem at the Cascade Laundry resolved itself as follows: Boilers supply steam to the uniflow engines, to the turbine (previous to the Diesel installation) to sundry laundry equipment and to heating radiators throughout the building. Exhaust steam is then drawn from these various sources and further used to heat the water for washing purposes. The laundry requires 60,000 gallons of wash water per hour which is drawn from the city mains at an average temperature of about 60 degrees and must be heated to 190 degrees. To accomplish this, 130 Btu. per pound of water are necessary. The difference between the total heat of exhaust steam from the engines and water at 190 degrees is approximately 1,000 Btu. Hence, one pound of exhaust steam can heat about 7.7 pounds of cold water to provide 8.7 pounds of hot water. Consequently, 57,500 pounds of exhaust steam per hour are required to supply 60,000 gallons (500,000 lbs.) of hot water to the washing machines. It is evident, therefore, that exhaust steam exceeding 57,500 pounds per hour goes to waste and an improper heat balance results.

This was the situation at Cascade due to a power demand increase out of proportion to the demand for water heated by exhaust steam. The obvious solution was to secure electric power by other means than steam generation. This was accomplished effectively and economically by the substitution of the Diesel for the turbine which, as previously stated, permitted one boiler to be shut down.

But what of the economy? The substitution of the Diesel unit for the turbo-generator has brought a net saving of approximately $35.00 per day. The substitution of the small Diesel generator set for Edison current is saving some $200.00 per month. There will be an additional saving in the near future when the proper piping changes are completed so that the hot jacket water discharge from the large Diesel engine can be used for boiler makeup feed. This will reduce the fuel burned under the boilers. No additions have been made to the engine room personnel. In fact, the same crew are running the combined plant as formerly operated the steam plant.

Performance of the new Diesels has been so satisfactory that the owners are planning to install an additional engine in their own garage.

IMPERIAL IRRIGATION DISTRICT

. . . . *Continued from page 25* . . . .

for each engine—located forward of the engines in a pit extending the length of the engine room. Lube oil pumps of 200 gpm. capacity are attached to the engines and draw oil from the aforementioned tanks, pumping through Braun oil coolers to the pistons and crankcase. Drain pipes of ample capacity lead the oil back to the tanks. In addition a spare independent electrically driven lube oil pump is provided for standby and priming purposes. Texaco "Ursa" lube oil is used for crankcase and piston cooling, "Ursa" heavy for force feed cylinder lubrication. Elliott strainers are used, one for each engine and one No. 13 Sharples en bloc lube oil purifier draws from all lube oil tanks.

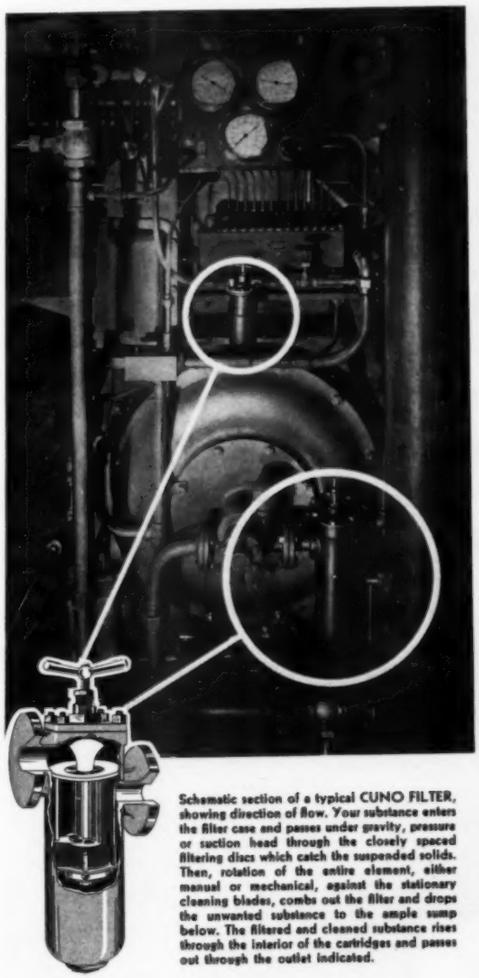
Fuel is stored in a 2,000 barrel storage tank, pumped from there to an underground service tank and to daily service tanks located on the roof of the building. The pumping arrangement is automatic, starting the Viking transfer pump when a predetermined level is reached in the daily supply tanks. In addition visible overflows are provided and alarm bells and lights are provided to go into action if the overflow stops. From the service tanks the fuel is led to the engines through Worthington meters and Nugent filters. One No. 15 Sharples en bloc fuel oil purifier handles the entire fuel supply for all three engines.

In addition to the Kinney gear type cooling water pumps attached to the engine, five independent driven water pumps are provided. Cooling water is drawn from a 10,000 gal. tank, pumped through the heat exchangers in the indirect cooling type Braun cooling tower and returned to the tank. Raw water is circulated over the tower. Make-up water from city system water is treated by the Zeolite system and addition of Sodium-Lichro. Temperatures in the Valley reach 125 deg. F. in the shade in the summer months, so the cooling system is made amply large. The heat exchangers for lube oil are cooled with raw water. This was necessary in order to keep down the size of oil coolers. Drop of cooling water temperatures through tower about 30 deg. Drop of oil through coolers 30 deg. Discharge temperature—water 120 deg., piston oil 140 deg.

Two starting tanks are provided, located outside of the building, 400 lb. pressure. The tanks are replenished by two Worthington air compressors, one electrically driven by Allis-Chalmers motor and tex rope drive; the other driven by a Novo gasoline engine. The latter is only used in case a complete shutdown and loss of starting air should occur, and it was, of course, used to put the plant in operation. The electric driven compressor is stopped and started automatically.

Clean air for combustion is assured by American Air Filters. Filter elements are located in boxes fastened to the pillars in front of the engines. A pipe leads from the box to a Burgess silencer located under the floor and from there the pipe leads to the intake of the Connersville blower. Fuel oil from Caminol refinery in Santa Fe springs is used. About 24 Baume, 60 vis. 200 flash, 1½ per cent carbon. Blended stock.

The building is of steel and galvanized iron and is equipped with a 10-ton Cyclops crane. A work shop well equipped is located at one end of the basement and, as will be seen by the plan on the first page of this article, plenty of room has been left for expansion. The plant is airy, clean, arranged for accessibility, all cooling water and oil lines are located in the basement and are easily accessible. On the main floor in one corner is located the chief's office, operator's dressing room, washroom, shower, etc.



Schematic section of a typical CUNO FILTER, showing direction of flow. Your substance enters the filter case and passes under gravity, pressure or suction head through the closely spaced filtering discs which catch the suspended solids. Then, rotation of the entire element, either manual or mechanical, against the stationary cleaning blades, combs out the filter and drops the unwanted substance to the ample sump below. The filtered and cleaned substance rises through the interior of the cartridges and passes out through the outlet indicated.

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Continuously Cleanable

FILTERS

The Namm Store, one of the large department stores in Brooklyn, N. Y., has a notable Diesel installation where CUNO Auto-Klean FILTERS play their small sized but vitally important role insuring clean oil. Here, store lighting, elevator load and other important services depend upon *Constant* POWER. With CUNO on the job, all danger of shutdowns due to unclean fuel and faulty lubrication is definitely eliminated.

Diesel engines are exposed to contamination by dust, yet dust and its blood-brothers—sludge and abrasives—are the elements that can prove most costly and even cause power failure. To guard against the insidious destruction of unseen and potentially abrasive substances in oil, many engineers depend upon the CUNO Auto-Klean FILTER as the one positive, permanent defense. Many notable Diesel engine builders, as well, use CUNOS on both fuel and lube lines as preferred standard equipment.

It's CUNO's steady, uninterrupted dependability that marks it the ideal strainer unit for the Diesel Power plant . . . Whether it's the first or the millionth gallon, CUNO's efficient metal discs reject every foreign substance, even moisture, from fuel and lubricating oils . . . and the BIG point is that CUNOS are *continuously cleanable*, while in service.

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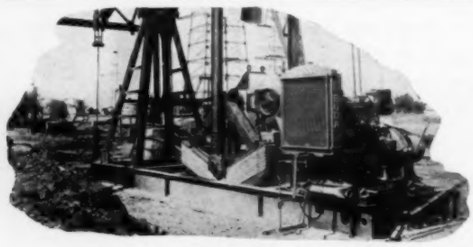
City & State _____



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For Gasoline—Diesel Engines

● Oil field service is of the very hardest type and requires equipment of exacting design and sturdy construction. Young radiators are invariably chosen for this service. Regardless of what your cooling problems may be there is a Young unit available to meet your conditions. Young engineering and factory facilities are at your disposal to design and build units to fill your particular requirements.

Write for New Catalogs

They cover complete information on the design and construction of units best suited to cool gasoline or Diesel-powered equipment.

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San Francisco, California
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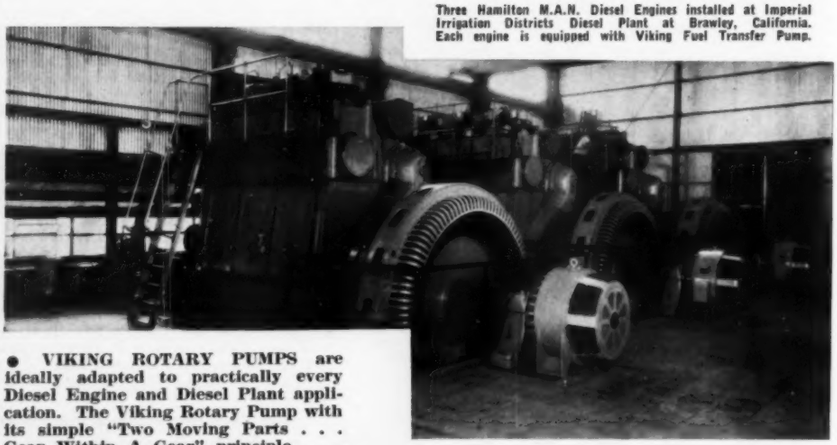
Young Quality

-another Diesel installation that calls for VIKING

Three Hamilton M.A.N. Diesel Engines installed at Imperial Irrigation Districts Diesel Plant at Brawley, California. Each engine is equipped with Viking Fuel Transfer Pump.



● **VIKING ROTARY PUMPS are ideally adapted to practically every Diesel Engine and Diesel Plant application. The Viking Rotary Pump with its simple "Two Moving Parts . . . Gear Within A Gear" principle . . . offers positive suction and discharge, low power requirements, compactness, dependability and a long life of trouble-free service on auxiliary Diesel equipment performance.**

Write for special Diesel Bulletin and Prices

Viking Pump Co.
Cedar Falls, Iowa

H. O. R. ENGAGES HEINRICH SCHNEIDER

HEINRICH SCHNEIDER has joined the Hooven, Owens, Rentschler Co. in Hamilton, Ohio, as Vice President in charge of Diesel Engineering and related activities, and as a member of the Board of Directors.

Mr. Schneider moves up to this position from an Assistant Vice Presidency of the American Locomotive Company in Auburn, N. Y., where he was in charge of Diesel Engineering during 1936 and where he has just completed a thorough reorganization of that department. His work there was concentrated on building up the existing engineering staff with a considerable body of specially trained personnel and on laying the foundation of a modernized Diesel engineering policy.

A native of Switzerland and a graduate of the University of Zurich, Mr. Schneider has had a notable career both in Europe and in the United States. After receiving his engineering degree he worked for some years as assistant to the world-famed scientist and engineer, Stodola, a position which led up to that of development and research engineer for the Vulcan Ship and Engine Works in Hamburg. For ten years he applied the most modern principles of thermodynamics, hydraulics, and internal combustion to the creation of marine power plants of various types, an activity which culminated in a four-year association with Dr. Hermann Foettinger, of hydraulic-coupling fame.

Returning to his native Switzerland in 1919, Mr. Schneider became chief engineer of the Swiss Locomotive Works in Winterthur.

The active part of Mr. Schneider's career in the U. S. A. may be dated from 1927, at which time he joined the staff of Fairbanks, Morse & Co. as research and development engineer. In this capacity, and up to the fall of 1935, he introduced noteworthy modifications into the entire existing line of Fairbanks, Morse engines, with substantial increases in capacity and efficiency based on the application of open-chamber combustion and back-flow scavenging principles. This work reached its climax in the design, development, and marketing of a line of light weight welded-steel opposed-piston engines involving unit-construction, hollow cast iron crankshafts for larger types, and other fundamentally new principles.

A dynamic personality with a prodigious capacity for work, Mr. Schneider nevertheless enjoys a reputation for good-fellowship with all his associates, from the lowest to the highest. His appealing personal manner has apparently made it unnecessary for him to take the attitude of a driver towards his co-workers in order to maintain the high rate of output which his career shows. The results of his association with the Hooven, Owens, Rentschler Company, whose past achievements in Diesel engineering afford him substantial foundations to build on, will accordingly be watched with interest.

DIESEL APPLICATION PLANBOOK REDUCTION IN PRICE

IT has been necessary for us to go back to press with the first edition of the *Diesel Application Planbook*. The sale of this book far exceeded our expectations and an additional imprint of five thousand is now in progress.

The unexpected volume of book sales has naturally spread our original cost over a wider base, so that it is now possible for us to offer this unique book at $3.50 per copy, postpaid.

The second imprint is exactly the same as the first in so far as editorial content is concerned, binding the same, paper and printing the same. You can now buy this $5.00 book for $3.50 and if it isn't satisfactory, you can return it to us in good condition within ten days of its receipt and your money will be promptly refunded.

The *Diesel Application Planbook* is the most useful book available today on the application and use of the Diesel Engine. Order your copy today from DIESEL PROGRESS, 2 W. 45th St., New York, N. Y., price $3.50 postpaid anywhere in the world and with a full return privilege.

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Let one of our engineers give you facts and figures on an economical Buckeye for your plant. No obligation.

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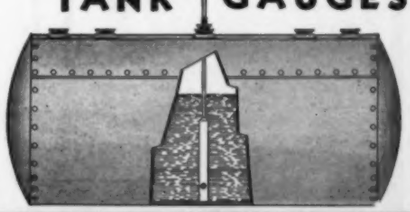

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No other Wrench would do as well-

"Keep Going" with Snap-on

• Tight quarters . . . 400 nuts in a few feet of space . . . BIG nuts that take muscle. The plant has to be kept going!

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Snap-on Socket Wrenches
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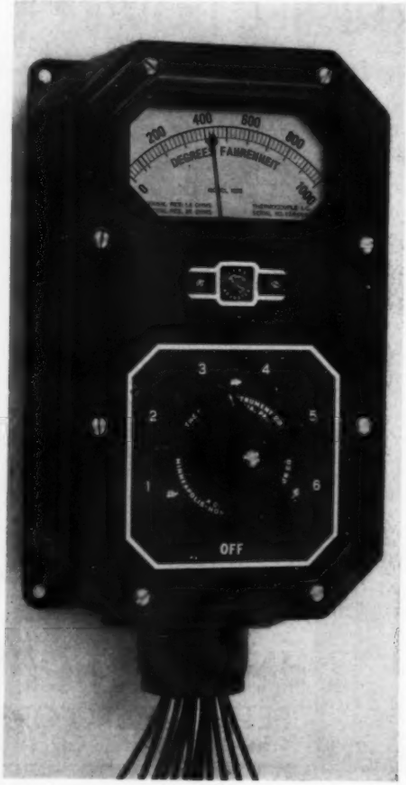
NEW PYROMETER

THE Brown Diesel Engine Pyrometer has been designed especially and specifically for use on Diesel engines.

Salient features of the new unit are of interest. The instrument is mounted in a molded Bakelite case. This insures light weight and permanency of finish plus a construction which is thoroughly moisture-proof. The dial type switch is integral with the pyrometer, mounted in a separate compartment of the same case, and each pyrometer is calibrated within 1 per cent of full range within the normal operating zone, and within 2 per cent outside of that zone. They are furnished in ranges 0-1000° F. to 0-1600° F. Although small and compact, the construction of the pyrometer is rugged and the switch contacts are made large enough to stand hard service. Overall dimensions are 9 7/16" high. 4¾" wide, and 3⅝" deep. The low resistance moving system is sensitive for standard ranges, and yet rugged enough to withstand severe vibration. The system is provided with a special "neutralizer" having a negative temperature coefficient. This permits the use of heavy springs in the system while still maintaining a low overall coefficient not more than 1 per cent for 10°C change in ambient temperature. Instruments with cold junction compensation can be furnished if desired.



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SYSTEM OF
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saves the dollars and cents that "vibrate" away!

With the prevention of the transmission of Diesel vibrations comes an increase in the efficiency of workers—a lessening of fatigue—a reduction of accidents. Those vibrations that rebound into the engine itself, causing strain and wear, are eliminated thereby saving you money by increasing the life of your equipment and cutting down repair costs. In addition neighbors and adjoining property owners are not annoyed and harassed.

Modern building construction of steel and concrete—excellent conductors of vibration—makes it increasingly advisable to consult the specialist, trained by long experience in vibration control.

30 years experience

An interesting and informative booklet describes the methods we use in controlling the transmission of machinery vibrations. This booklet — ISOLATION — will be sent free, without obligation. Write for your copy now.

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ANTI-VIBRATION PRODUCTS

National Forge and Ordnance Company

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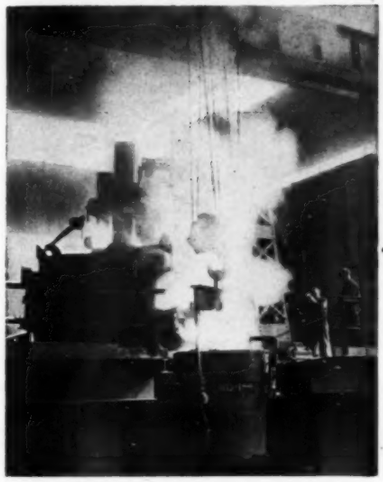

All National Forge and Ordnance Company products are manufactured from fine quality Basic Electric Steel.

Complete control of all processing from selection of the melting charge to the finished condition is National Forge and Ordnance Company's guarantee for maintenance of quality in crankshafts and various other types of forgings furnished to leading manufacturers in the Diesel industry.

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The most exclusive Diesel Training School on Atlantic Coast. Combination Home Study, including six weeks' practical shop work.

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LONDON LETTER No. 15

. . . . *Continued from page 33* . . . .

three months ago, that in view of the satisfactory results of the company's Diesel-electric train "Cometa" in improving the service between Sao Paulo and Santos, two more Diesel electric trains were under consideration. These trains have now been supplied by Sir W. G. Armstrong Whitworth & Co., Ltd., the manufacturers of the 450 bhp. "Cometa," and are 600 bhp. streamlined units, each consisting of a power car and three passenger coaches.

The previous train employed articulated bogies, but in this case close-coupled independent units are used, with increased seating capacity. Pressure-charging of the engine is incorporated, the same 450 bhp. Armstrong-Sulzer engine as was used in the earlier cars being used, but with its power increased by means of a Büchi exhaust gas-driven supercharger. The new rated output of the engine is 600 bhp.

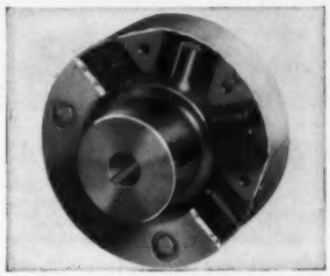
The forerunner of the two new trains, the "Cometa," is illustrated on another page. Since being put into service in July, 1934, it has run approximately 110,000 miles; the service has now been increased from two round trips, six days per week, to three round trips per day and two on Sundays. One-and-a-half hours per round trip is occupied on the cable railway ascending 2,600 ft. from the coast at Santos to the plateau of the mainland.

Fuel consumption has averaged 3.3 miles a gallon and lubricating oil 200 mpg. Periodic overhauls of the engine, after making allowances for the distance covered on the ropeway, have been the preliminary examination, occupying three days, after 18,000 miles, a further examination occupying four days after 59,000 miles, and a recent overhaul of which no details have come through yet. Routine maintenance of the engine, periodic overhauls, and an allowance for general overhaul at the end of two to three years, amounts to approximately 20 man-hours per thousand miles, and engine spares to 15 to 20 shillings.

EDITOR'S NOTE: The subject which Mr. Lind has chosen for his *London Letter No. 16* which will appear in the March issue of DIESEL PROGRESS deals with "small marine matters." According to Mr. Lind's most recent communication with this office, a number of very interesting and noteworthy items have appeared in regard to the small marine Diesel field in England and on the Continent which he believes would provide the basis for some interesting comparisons by American readers.

RADIAL MORFLEX COUPLINGS

(made by the makers of Morse Reduction Gears and Silent Timing Chains)



Cut-away view showing rubber elements

Stop Vibration, Noise and Bearing Wear

• Morse Radial Morflex Couplings have no equal as engine couplings. Now widely used in Diesel field. Absorb shocks and vibration. Minimize bearing friction, noise and wear. Compensate for slight shaft misalignment. Require no lubrication. Ask your engine dealer, or write us for complete information. Please include dealer's name.

MORSE CHAIN COMPANY
DETROIT, MICHIGAN
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IMPROVED LUBRICATION

". . . it was at this meeting that we decided to further improve Gulfpride, the world's finest motor oil," said Mr. H. P. Hobart, General Manager, Gulf Oil Corporation, in explaining the significance of a picture he is pointing out to Mr. D. P. Clark, Assistant General Manager of Gulf Lubrication Sales.

This picture is one of the original oil paintings and water colors, used by Gulf in its magazine advertising, now on exhibition at the Gallery on the third floor of the Gulf Building in Pittsburgh.

"We have found," continued Mr. Hobart, "that by applying Gulf's exclusive Alchlor Refining Process to the finest Pennsylvania crude, we could make a fine motor oil still finer. Knowing this, we decided right then and there to make the change. That's why we call this painting by Frank Hoffman, 'When the world's finest motor oil wasn't fine enough.'"

NEW OIL PURIFIER

THE remarkable performance of Diesel engines in many new fields has resulted in a great increase in the number of small and medium sized Diesel engines. To correctly serve these engines there has been created a need for the 400 series Goulds Hydroil centrifugal oil purifier.

The trend in design of medium and small sized engines has been to higher rotative speeds with higher piston and valve speeds. Great care has been exercised in the design of these high speed engines and they must be properly lubricated with clean oil continuously.

Oil refineries are meeting this situation by producing high quality Diesel engine lubricating oils. The function of the Hydroil Purifiers is to maintain the original lubricating value of the oil.

The higher rotative speeds require correspondingly faster moving parts in the fuel syystem. Multiple cylinder construction and modern design of injection nozzles require very small openings. For satisfactory performance, Diesel fuel must be clean and free from water.

The 400 Series Goulds Hydroils have been developed to enable the modern small or medium sized power plant to obtain efficient purification at low cost.

Goulds Hydroil Bulletin No. 502, just published, will be sent upon request to the editor.

LESSON IN ANCIENT
(and Modern)
ENGINE HISTORY

What made the gasoline engine practical for autos, father?

The development of the Bosch magneto, my son.

What made the high speed Diesel engine practical, father?

The development of the solid injection principle, my son.

Who pioneered this principle?

Strange to say, the same organization which developed the Bosch magneto...or maybe it isn't so strange...

Engine history repeats itself. American-Bosch, world's largest manufacturer of magnetos, today supplies fuel injection equipment to the majority of Diesel engine manufacturers. Thus is emphasized anew the industry's unswerving reliance on American-Bosch for plus-standards of engineering and manufacturing excellence.

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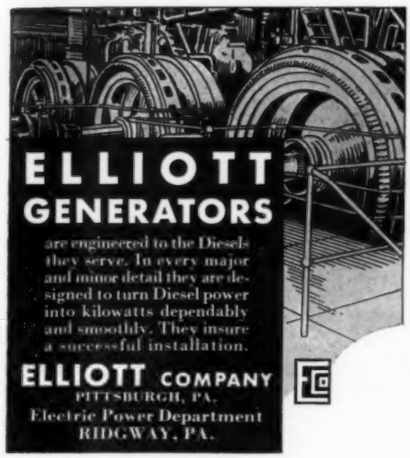

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are engineered to the Diesels they serve. In every major and minor detail they are designed to turn Diesel power into kilowatts dependably and smoothly. They insure a successful installation.

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Now available with **DIESEL POWER**

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vested in Hemphill graduates, by their employers, is proof of the thorough and practical training they received.

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"On Dec. 4th I will have been in the employ of the Mines as Chief Engineer for one year. The plant consists of two 300 hp. units."

"I have been promoted to Chief Engineer, in entire charge of the Diesel engines in this plant."

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DIESEL PROGRESS

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This meter which measures through true positive piston displacement will measure fuel oil accurately over any range of flow regardless of variation in inlet or flowing pressure.

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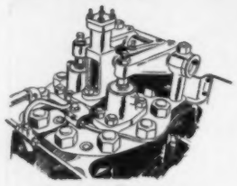


How to get better Results from your Diesels

Standard Oil has a diesel oil that may surprise you by the way it reduces carbonization and gumming around rings and piston skirts. What's more, it reduces the carbonaceous deposits found in exhaust passages and changes their character to a softer, less harmful form. Its name is ***Nonpareil.***

Nonpareil Diesel Oil is only one of many Standard Oil lubricants, each of which has been developed to do a specific job economically and efficiently. Listed below are two diesel lubricants which lower maintenance costs and give better results. Find out more about them!

NONPAREIL DIESEL OIL—furnished in three grades: Medium, Heavy and Extra Heavy. It is a highly refined, pure mineral oil of exceptional cleanliness, and possesses a good rate of separation from water. It lowers oil consumption, because of its excellent reclamation possibilities. It can be used effectively for power and air cylinder as well as bearing lubrication.

STANOLIND M OIL—A high-grade, heavy-bodied, compounded oil for use in wet injection engines or in air compressors troubled with moisture. This oil should be used for air compressors which tend to rust when operated intermittently.

Here you'll find Practical Suggestions and Tips on all phases of Diesel Lubrication!

Interested in a little "homework" on the finer points of diesel lubrication? The booklets listed here contain discussions of basic problems and practical, proved advice on how to solve them. These monographs were prepared by the Standard Oil Engineering Staff and have proved valuable to many operators of diesel engines. Send for those you desire. There is also a growing library of other booklets covering a wide range of specific lubrication problems which will be sent to you upon request. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois.

"Diesel Engine Bearing Lubrication"
"Lubrication of Diesel Air Compressors"
"Diesel Engine Air and Fuel Cleaning"
"Diesel Cylinder Lubrication"

The Lubrication Engineer...Takes his own "Medicine"!

THE squeak in that desk chair did seem like one problem Joe *should* be able to solve! He has an unusually successful record in solving tough lubrication problems. That adds spice to the humble fix we find him in here. Standard lubrication engineers are only human after all, and it's pretty clear they aren't going to let Joe's head swell!

It happens this man specializes in a field that's been developing rapidly—presenting new lubrication problems. He's been able to fit lubricants to jobs a little more exactly, suggest improved methods of application, and adjust feeds more economically. This has helped the men who've called him in to show creditable new strokes of economy in the operation of their own departments. Naturally, he's been getting more and more popular!

Each of Joe's fellow lubrication engineers "specializes" more or less. Each has had years of practical experience licking lubrication problems in his chosen fields.

There's a group of just such practical lubrication engineers in your own, local, Standard Oil (Indiana) office. One of them is *particularly* prepared to help you solve the type of problems *you* meet. Phone Standard Oil and find that man! You'll find him a profitable friend.

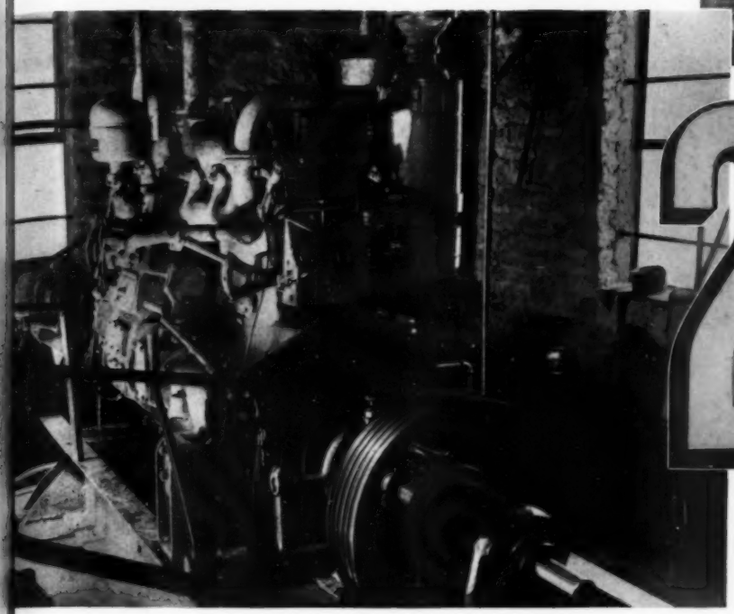
Don't feel the lubrication problem you have in mind is too big to permit you to ask for this free service. Don't feel it's too trivial. (Often a problem that seems trivial may be the "key" to far-reaching savings.) Use your Standard Lubrication Engineer for a complete plant survey . . . or for curing the squeak in your own desk chair!

Copr. 1937, Standard Oil Co.

STANDARD OIL COMPANY (INDIANA)

CORRECT LUBRICATION

8 MILES TO GO



20 HOURS PER DAY

AT Salem, Indiana, a "Caterpillar" Diesel Engine carries the main responsibility for municipal water supply. This service must be unfailing twenty hours a day—and twenty-four hours if necessary. Twelve thousand gallons per hour are pumped a distance of eight miles to the filtering and chlorinating station. Engine operating cost averages *only 16c per hour.* Louis Languell, superintendent of the plant, states that "this 'Caterpillar' Diesel Engine was decided upon in preference to all other types of power. . . . It is serving us faithfully and economically."

"Caterpillar" Diesel power makes small plants pay because it costs so little—for fuel, for lubricating oil, for up-keep. "Caterpillar" Diesel Engines come in five sizes,* covering a wide range of applications. There's a dealer near you—with factory-trained service men and stocks of machines and parts.

76 LEADING MANUFACTURERS POWER THEIR PRODUCTS WITH "CATERPILLAR" DIESEL ENGINES

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Brookville Locomotive Company . . . Brookville, Pa.
The Browning Crane & Shovel Co. . . . Cleveland, O.
The Buckeye Traction Ditcher Co. . . . Findlay, O.
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***MODEL 17000—160 HP. • MODEL D13000—125 HP. • MODEL D8800—80 HP. • MODEL D6600—60 HP. • MODEL D4400—44 HP.**

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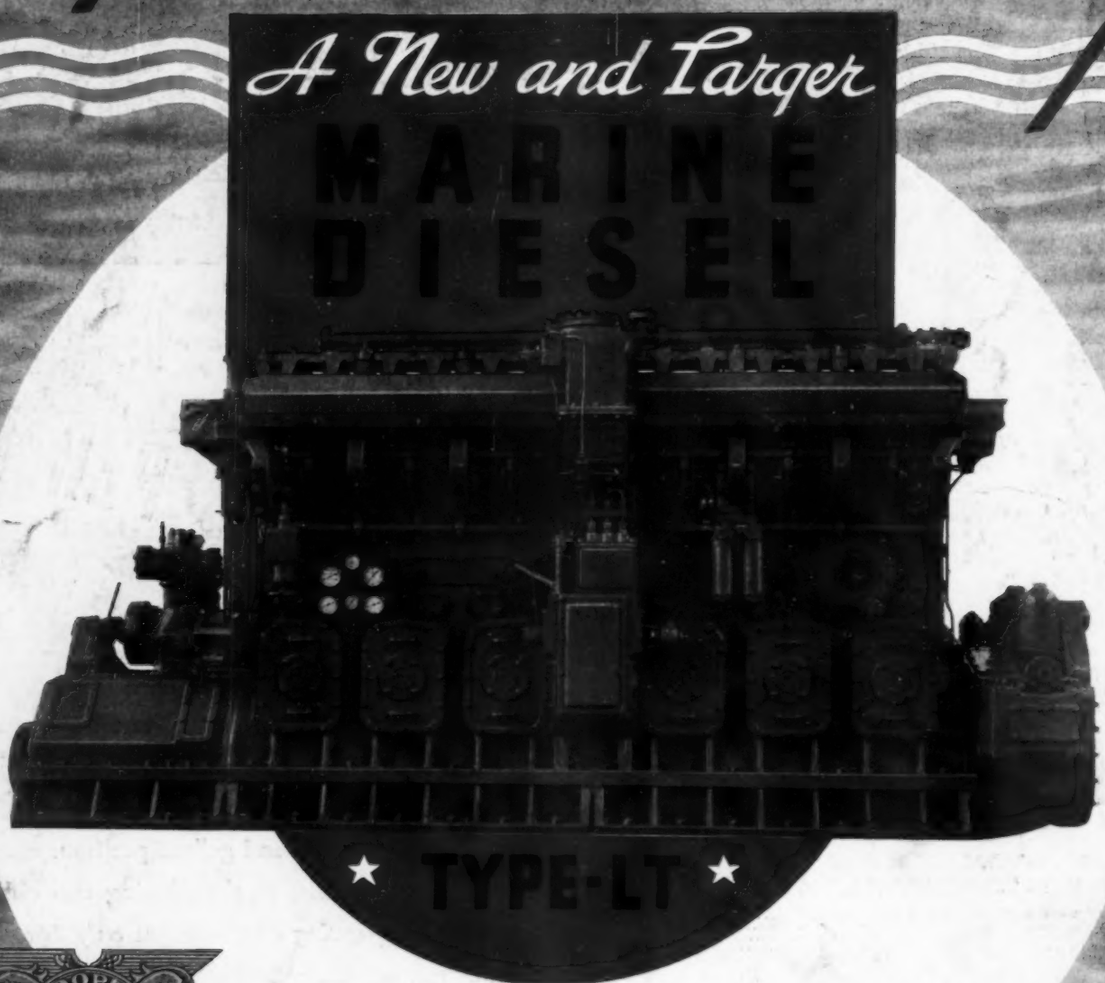

Type LT is a new engine, and a new size, in the Cooper-Bessemer line of Diesels for general marine propulsion. Rated from 625 to 1000 H. P., Type LT is built in six, seven, and eight cylinders; direct-reversing. Bore and stroke are 15½" x 22".

Features:

- ★ Extra sturdiness in every piece and part.
- ★ Thru-bolt construction carries all heavy stresses.
- ★ Replaceable cylinder liners.
- ★ Heavy-duty crankshaft, connecting rods, bearings.
- ★ Complete pressure or circulating lubrication to all wearing parts.
- ★ More uniform cooling increases life of liners, pistons and piston rings.
- ★ Patented *atmospheric relief* constant-pressure fuel injection.

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